About the Coral Monitoring Station (CMS) Network

Coral reefs experience significant direct and indirect anthropogenic pressures, including rising sea temperatures, ocean acidification, and pollution (chemical and physical). Monitoring coral health and how it is affected by environmental conditions is essential to better inform science, management, and policy. The fragile state of most reef ecosystems makes it urgent to generate accurate and actionable monitoring data at the temporal and spatial scales at which the stressors act.

This is particularly true in the Gulf of Aqaba (GoA), one of the planet's last known marine refuges from climate change, due to the extraordinary thermal tolerance of its reef-building corals. The urgent need for scientific data and evidence-based management in the Red Sea region motivated us to establish a network of Coral Monitoring Stations (CMS).

The world's first real-time, open-access coral monitoring network was launched in the GoA to collect multiple environmental and physiological data streams. These data are curated in an open-access online database to enable collaboration among scientists worldwide and to enhance understanding of coral responses to environmental variability. Our vision is to expand this network to strategic locations throughout the GoA and the broader Red Sea.

Monitoring Stations

CMS I – Open Reef, Eilat

CMS I, the first node in the network, monitors coral health at a depth of 7 meters in an open reef setting in Eilat. The system collects real-time data on water temperature, light intensity and chlorophyll fluorescence.

Photosynthetic performance is measured using PAM fluorometry on eight coral colonies: four *Stylophora pistillata* and four *Pocillopora damicornis*. These data streams are complemented by periodic physiological and genetic sampling. A live underwater camera provides visual data on fish diversity, coral pigmentation, and reef dynamics.

The nearby environmental monitoring station of the National Monitoring Program of the Gulf of Eilat provide additional data on wind speed and direction, currents, light and temperature above water and at the surface, tides etc.

CMS II – Dolphin Reef, Eilat

CMS II was recently deployed at the Dolphin Reef site in Eilat, a semi-enclosed lagoon surrounded by a wave and wind breaker that enhances wave lensing, short bursts of focused sunlight caused by surface wave dynamics.

At this site, six *Stylophora pistillata* colonies are monitored at a depth of 6 meters using six PAM sensors to measure real-time photosynthetic performance. Light intensity and temperature data are recorded and averaged across sensors to characterize site-specific environmental conditions.

By comparing CMS II with CMS I, researchers can evaluate how sheltered versus open reef conditions and variable light regimes affect coral physiology and resilience.

CMS III – Mesophotic Reef, Eilat

CMS III operates at a mesophotic depth of 42 meters in Eilat, enabling monitoring of deeper reef habitats. It focuses on two coral species: the branching depth-generalist *Stylophora pistillata* and the laminar depth-specialist *Leptoseris glabra*.

Eight coral colonies are monitored using PAM fluorometry, providing high-resolution data on photosynthetic performance. Environmental data including temperature and light are provided by Israel's National Monitoring Program of the Gulf of Eilat.

Together with CMS I and II, this station contributes to a multi-depth, multi-environment assessment of coral reef function under varying light, depth, and thermal regimes.

All CMS data are archived and made available to researchers, managers, students, educators, and the public through an open-access online portal. The system enables both real-time observation and historical data downloads.

As the network expands, scientists from across the Red Sea region and from around the world are invited to plug-in sensors and instruments on an open-access basis. We believe that open science data will not only promote conservation of coral reefs but also foster regional scientific collaboration and innovation.

Parameters Monitored

- PAR (Photosynthetically Active Radiation): Quantum flux density (µmol photons m^{-2} s^{-1}) measured near coral colonies.
- TEMP: Seawater temperature (°C) recorded next to the monitored colonies.
- Chlorophyll fluorescence (Ft): The momentary fluorescence level of an illuminated sample just before application of a saturation pulse.
- Y(II): Effective photochemical yield of Photosystem II, estimating photochemical energy use in light.
- ETR: Relative electron transport rate in Photosystem II.

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