

The Aquarius Coral Reef Observatory: A Flexible Remote Sensing Solution for the Florida Reef Tract

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Monitoring spatiotemporal patterns of environmental conditions in sensitive marine habitats – such as the Florida Reef Tract – is critical for informing conservation, restoration, and adaptive management strategies. In recent years, the advancement of remote sensing technologies has improved our capacity to reliably collect data over extended time periods at lower costs; the perfect solution for efficient environmental monitoring. Improvements in battery performance, communication solutions, sensor accuracy, and onboard processing have also driven down cost while simultaneously expanding potential applications. More than ever, designing affordable remote sensing networks with real-time communications is possible, providing an opportunity to collect time-series data from vast areas for monitoring and to support early warning systems responding to environmental disturbances. Here, we introduce the Aquarius Coral Reef Observatory (ACRO) – an open-source, internally-developed remote sensing system designed to accommodate a wide range of sensors. ACRO was conceived as both a working observatory and an adaptable prototype to enable greater access to real-time marine data and as a test bed for research and development. The current system is built around a Windows-based operating system to support instrument-specific requirements and edge-processing capabilities but integrates microcontroller-based systems for greater flexibility in the future. The observatory currently supports an ADCP, two wideband echosounders, a water quality sonde, multiple cameras, a hydrophone, imaging sonar, and expansion capacity for additional tools. The ACRO itself represents a single node in a network of over 15 FIU managed platforms distributed across Biscayne Bay and the Florida Keys that stream data to a centralized web repository developed by the FIU Institute of Environment. Our objectives with the ACRO system specifically, are twofold: 1) to leverage Aquarius Reef Base infrastructure as a testbed for scalable observatory design across reef sites such as those identified by Mission: Iconic Reefs, and 2) to foster collaboration and innovation in marine sensing through a low-cost, customizable observatory model. Collectively the overarching goal of the monitoring network is to deliver accessible, real-time environmental data to stakeholders and managers throughout South Florida as a public service and in an effort to inform future management practices.