

Development of a Comprehensive Decision Support System for Florida's Coral Reef

Nicholas Alcaraz¹, **William McClintock**², **Brian Walker**³, **Chad Burt**², **David Kochan**¹, **Samantha Buckley**³, **Maya Becker**³, and **Christina Mallica**¹

¹Florida Fish and Wildlife Research Institute, Saint Petersburg, FL, USA

²University of California Santa Barbara, Santa Barbara, CA, USA

³ Department of Marine and Environmental Sciences, Halmos College of Arts and Sciences, Nova Southeastern University, Dania Beach, FL, USA

Florida's Coral Reef has experienced a series of widespread disturbances, including an extreme heating event and lethal coral disease outbreak. The loss of coral cover across the reef has led to a large investment in management and restoration activities. In response, the Florida Fish and Wildlife Research Institute, Nova Southeastern University, and The Spatial Collaborative have developed the Coral Reef Decision Support System (CRDSS) — a modern, scalable, and interactive tool for coral reef conservation and restoration planning. A decision support system is built to access and leverage information — containing a combination of raw and derived data, documents, and personal knowledge. The CRDSS is built on the SeaSketch platform, a cloud-based system for spatial planning customized to support the selection, evaluation, and documentation of restoration sites across the full extent of Florida's Coral Reef. Construction of the tool within SeaSketch allowed for the rapid deployment of core GIS functionality and a greater focus on the development of customized features. The platform equips managers, scientists, and practitioners with tools for data visualization, interactive filtering, sketch-based site planning, and automated reporting. These features collectively enable a rigorous and collaborative decision-making environment where inputs can be saved and shared for replicability and transparency. At the heart of the CRDSS is a high-resolution, hexagon-based planning grid (using Uber's H3 spatial index), which supports real-time, sub-second analysis across 7.4 million planning units. A custom-built filtering engine, powered by the DuckDB analytical database, allows users to interactively explore and isolate potential restoration areas based on physical, ecological, and human-use criteria. To support site-specific planning, CRDSS users can digitize restoration areas directly on the map. Each polygon is automatically analyzed against a suite of data layers, with tailored reports summarizing conditions such as depth, habitat type, and nearby human impacts. This process enables users to evaluate sites quickly and refine their plans based on immediate data-driven insights. The CRDSS represents a significant advancement in Florida's reef restoration toolkit and provides a foundation for more data-informed, transparent, and collaborative restoration strategies.