

EXECUTIVE SUMMARY

For over three decades, scientists have been documenting the decline of coral reef ecosystems, amid increasing recognition of their value in supporting high biological diversity and their many benefits to human society. Coral reef ecosystems are recognized for their benefits on many levels, such as supporting economies by nurturing fisheries and providing for recreational and tourism opportunities, providing substances useful for medical purposes, performing essential ecosystem services that protect against coastal erosion, and providing a diversity of other, more intangible contributions to many cultures. In the past decade, the increased awareness regarding coral reefs has prompted action by governmental and non-governmental organizations, including increased funding from the U.S. Congress for conservation of these important ecosystems and creation of the U.S. Coral Reef Task Force (USCRTF) to coordinate activities and implement conservation measures [Presidential Executive Order 13089].

Numerous partnerships forged among Federal agencies and state, local, non-governmental, academic and private partners support activities that range from basic science to systematic monitoring of ecosystem components and are conducted by government agencies, non-governmental organizations, universities, and the private sector. This report shares the results of many of these efforts in the framework of a broad assessment of the condition of coral reef ecosystems across 14 U.S. jurisdictions and Pacific Freely Associated States. This report relies heavily on quantitative, spatially-explicit data that has been collected in the recent past and comparisons with historical data, where possible. The success of this effort can be attributed to the dedication of over 160 report contributors who comprised the expert writing teams for each jurisdiction. The content of the report chapters are the result of their considerable collaborative efforts.

The writing teams, which were organized by jurisdiction and comprised of experts from numerous research and management institutions, were provided a basic chapter outline and a length limit, but the content of each chapter was left entirely to their discretion. Each jurisdictional chapter in the report is structured to: 1) describe how each of the primary threats identified in the National Coral Reef Action Strategy (NCRAS) has manifested in the jurisdiction; 2) introduce ongoing monitoring and assessment activities relative to three major categories of inquiry – water quality, benthic habitats, and associated biological communities – and provide summary results in a data-rich format; and 3) highlight recent management activities that promote conservation of coral reef ecosystems.

Due to the wide variety of monitoring and assessment techniques employed by each jurisdiction, as well as the variations in spatial and temporal resolution of the data being collected, it is necessary to evaluate each jurisdiction independently over time and resist the temptation to compare jurisdictions. Only data collection efforts that employ consistent methods across jurisdictions will allow for the comparison of data values; such regional efforts are underway and are beginning to yield results. At this point, however, the limited ability to make cross-jurisdictional data comparisons restricted the authors of the National Summary chapter to conclusions that are primarily qualitative. Still, useful conclusions can be drawn with regard to variables being monitored, data gaps that exist, general trends in the condition of resources, and national-level progress toward conservation activities.

Ultimately, the goal of this report is to answer the difficult but vital question: what is the condition of U.S. coral reef ecosystems? Coral reef ecosystems clearly are beset by a wide array of significant threats, and while managers and scientists may be able to demonstrate improvements in some aspects of an ecosystem, deterioration in other aspects may yield an overall conclusion of 'no change' or decline. A valid response to the above question is that it is too soon to tell, not because deterioration or recovery is in an early stage, but because the necessary long-term datasets that quantify such conditions have not been amassed. Few monitoring programs have been in place for longer than a decade, and many have been initiated only within the past two to five years. Some of these monitoring programs are still in their infancy and have not collected enough data to provide conclusive results. With continued support of these critical monitoring activities, however, trends may become more apparent over time.

Major conclusions of this report related to the threats and stressors impacting coral reef ecosystems indicate that some appear to be intensifying while others are decreasing in intensity. Climate change was identified by 11 of the 14 jurisdictions (78%) as being a moderate (6) or high (5) threat to coral reef ecosystem resources.

Climate change, whether due to natural variability or human activity, is central to several of the threats impacting coral reef ecosystems. Potential impacts from climate change on coral reef ecosystems include modification of water chemistry and sea level rise that may affect coral growth, the greater incidence and prevalence of coral bleaching associated with increased sea surface temperatures, and the increased intensity and frequency of storm events. Coastal development was cited as a moderate (2) or high (8) threat in 10 of the jurisdictions. Coastal development and population growth, whether permanent or temporary (such as in the case of tourism), are correlated with the intensification of several threats because development frequently translates to increases in pollution entering the marine environment; sedimentation from construction, agriculture, and road-building activities; and physical damage from recreational users through trampling, vessel groundings, or the use of anchors in fragile habitats. Another urgent threat, which was cited as a moderate (6) or high (8) threat by all of the 14 jurisdictions, stems from fishing. Changes in the populations of marine organisms, and fish in particular, can have far-reaching cascade effects throughout the ecosystem. For example, the removal of herbivorous fish may precipitate changes in benthic communities by favoring algal species that can outcompete corals following a release of predation pressure. The removal of top level predators may have a cascading effect on the entire ecosystem by reducing overall ecosystem productivity and upsetting the balance of energy flow throughout the system with unknown consequences.

Improvements in the status of some threats have also been documented. One positive development has been the removal of over 400 tons of marine debris, largely nets and fishing line, from the shallow reefs of the Northwestern Hawaiian Islands. In addition, many jurisdictions continue to install mooring buoys to help minimize anchor damage while facilitating access for recreational activities. Management of the trade in aquarium fish has resulted in more protection for some U.S. coastal areas, and implementation of the provisions of the Convention on International Trade in Endangered Species of Wild Flora and Fauna and the Federal Endangered Species Act extend protection to coral species, largely prohibiting their sale or exportation. In addition, nine grounded, rusted-out fishing vessels were removed from a reef flat in Pago Pago Harbor, American Samoa. These and other important improvements are detailed in the jurisdictional chapters.

Other important conclusions can be drawn in relation to advancements in management and conservation science. Major highlights include the progress made in the development of tools that scientists and coastal managers use to measure the condition of the resources. Digital map products of nearshore (< 30 m) coral reef habitats now exist for most jurisdictions and are being used to structure monitoring programs, inform management decisions, and build capacity in current and future coastal managers. Complementary multibeam maps of mid-depth (>20 m) environments are also being developed, and products are becoming increasingly available. Techniques to investigate genetic linkages among populations and identify and track the spread of coral disease are becoming more sophisticated and more widely disseminated. Other research is being conducted to determine optimal restoration techniques and calculate resource damages, which enables natural resource trustees to seek compensation for injured coral reef ecosystems and devote those funds toward restoration and monitoring activities. Advances in satellite observing systems and the deployment of additional buoys that monitor oceanographic conditions continue to improve the ability to characterize coral reef ecosystems.

As implementation of the NCRAS continues, it is crucial that existing gaps, especially in the shortage of trained personnel and infrastructure, be filled with additional resources. Without the availability of reliable, consistent data collected at sufficient spatial and temporal resolutions, answering management questions and evaluating management effectiveness cannot be confidently achieved.

This report represents the second in an ongoing series of reports that integrate the wealth of quantitative and qualitative information on the condition of U.S. coral reef ecosystems that has emerged since the inception of the USCRTF. Future reporting efforts will continue to document progress toward the goals outlined by the USCRTF and in the NCRAS and contribute to a broader understanding of U.S. coral reef ecosystems.