CORAL REEF CONSERVATION PROGRAM

Strategic Plan

2018

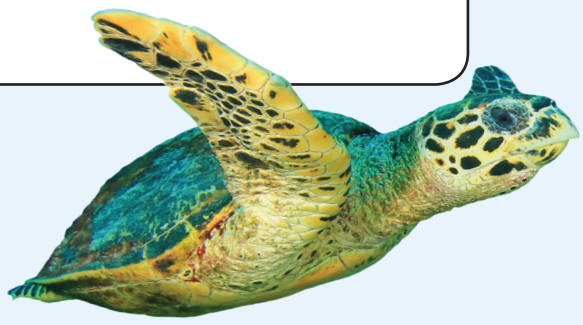
NOAA Coral Reef Conservation Program Vision

Through effective management, coral reef ecosystems are thriving, diverse, resilient, and able to sustain valuable ecosystem services for present and future generations.

NOAA Coral Reef Conservation Program Mission

"(1) To preserve, sustain, and restore the condition of coral reef ecosystems; (2) to promote the wise management and sustainable use of coral reef ecosystems to benefit local communities and the Nation; (3) to develop sound scientific information on the condition of coral reef ecosystems and the threats to such ecosystems; (4) to assist in the preservation of coral reefs by supporting conservation programs, including projects that involve affected local communities and nongovernmental organizations; (5) to provide financial resources for those programs and projects. . . ."

– Excerpted from the Coral Reef Conservation Act of 2000



From the Director

Covering just a tiny fraction of the earth's surface—less than 1 percent—shallow-water coral reefs sustain and protect human lives, livelihoods, and coastal property. A conservative estimate for the global value of reef tourism is $36 billion per year. When food production and property protection are added, global services are estimated at $172 billion per year.

Looking through a domestic lens, coral reefs in Southeast Florida, for instance, have a value of $8.5 billion, generating $4.4 billion in local sales, $2 billion in local income, and 70,400 full- and part-time jobs. NOAA's National Marine Fisheries Service estimates the annual value of U.S. commercial fisheries from coral reefs to be over $100 million. Reef-based recreational fisheries likely generate another $100 million or more. While marine pharmaceutical research is in its infancy, drugs derived from corals and reef-associated organisms are already successfully treating pain, infection, inflammation, asthma, and several types of cancer. Multiple threats have put coral reefs and their ecosystem services at risk. Pollution, fishing impacts, a changing global climate, and other stressors have destroyed or severely damaged many of the world's reefs. Twenty additional shallow-coral species were listed as threatened under the Endangered Species Act in 2014, and coral reefs subsequently experienced unprecedented losses during the third global bleaching event in 2014-2017.

The Coral Reef Conservation Program is taking proactive measures to address these declines by leading efforts to understand and conserve these precious resources. This strategic plan incorporates lessons learned from recent programmatic assessments, and its implementation is predicated on employing an adaptive management strategy. This approach will improve the plan's execution and likelihood of success.

We need corals, and corals are in crisis. On behalf of the entire Coral Program, thank you for your interest in our strategic plan and your continued support of coral reef conservation.

NOAA Coral Reef Conservation Program

Note: The sources for the information found in this note are listed at the end of this publication.

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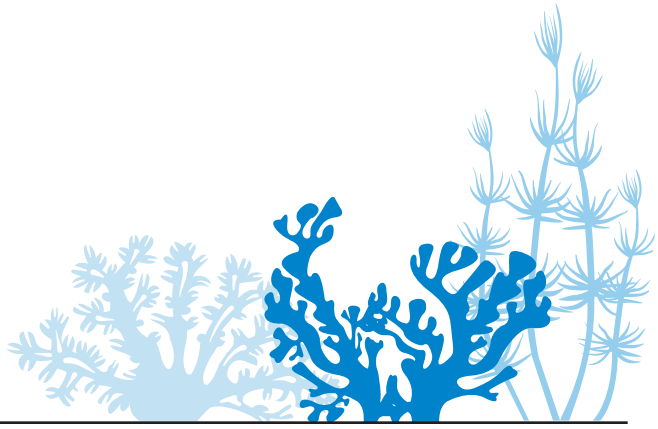

VISION

Thriving, diverse, resilient coral reefs that sustain valuable ecosystem services for current and future generations.

Increase resilience to climate change

Strategy 1. Support a resilience-based management approach

Improve fisheries' sustainability

Strategy 1. Provide data essential for coral reef fisheries management

Strategy 2. Build capacity for coral reef fisheries management

Reduce land-based sources of pollution

Strategy 1. Develop, coordinate, and implement watershed management plans

Strategy 2. Build and sustain watershed management capacity at the local level

Restore viable coral populations

Strategy 1. Improve coral recruitment habitat quality

Strategy 2. Prevent avoidable losses of corals and their habitat

Strategy 3. Enhance population resilience

Strategy 4. Improve coral health and survival

About the Strategic Plan

The goal is to reduce threats affecting coral reefs, particularly in U.S. waters, and to restore coral ecosystem function at an ecological scale.

The plan is ambitious, covers far more work than a single organization can achieve alone, and is aspirational to catalyze action for positive change. The plan lays out a framework for the coral conservation community and identifies opportunities to leverage expertise and resources across multiple agencies and organizations and to create new partnerships across the broader conservation community (identified by pillar below).

This strategic plan uses a resilience-based management approach, focused on conservation that supports the ability of corals to withstand and recover from stress. Activities include protecting naturally resilient areas, reducing sources of pollution, preventing damage to reef habitat, and preventing overharvesting of herbivorous fishery species, e.g., parrot fish and sea urchins.

The focus of this plan is on U.S. coral reef ecosystems, and NOAA will work closely with the seven states and territories (American Samoa, Commonwealth of the Northern Mariana Islands, Florida, Guam, Hawaii, Puerto Rico, and U.S. Virgin Islands) that have coral reefs ("jurisdictions") and a range of partners, including the fishery management councils, sister federal agencies, municipal

governmental agencies, nongovernmental organizations, and academia. Additionally, the Coral Program supports capacity-building activities in the Caribbean, Micronesia, Southwestern Pacific, and the Coral Triangle, which have ecological connections to U.S. coral reefs.

Long-Term Conservation Goals[1]

- Corals: By 2040, resilient, genetically diverse, reproductively viable populations of key coral species have been restored or preserved to maintain ecosystem function in key reef sites.
- Fisheries Taxa: By 2040, 100 percent of key coral reef fisheries taxa have stable or increasing abundance and average size in U.S. waters.
- Water Quality: By 2040, 100 percent of key watersheds have stable or improved water quality.
- Coral Recruitment Habitat: By 2040, at least 40 percent of the consolidated substrate at key reef sites remains free of sediment and macroalgal cover and hosts conditions that support recruitment.

Developing the Strategic Plan

This strategic plan builds upon the momentum and successes achieved through execution of the previous strategic plan, and contains four main pillars of work.

- Climate Pillar: Increase Resilience to Climate Change
- Fisheries Pillar: Improve Fisheries Sustainability
- Pollution Pillar: Reduce Land-Based Sources
- Restoration Pillar: Restore Viable Coral Populations

The pillars identify strategies to reduce threats and restore corals; however, the program recognizes that these threats are often cumulative with synergistic effects. When executing this plan, consideration of interactions between the different pillars is necessary for successful conservation results. Resilience-based management is the unifying approach for the work of all pillars and guides the Coral Program and its partners to invest strategically in conservation. For example, all projects undertaken will be planned with a view of what future environmental and climatic conditions will be.

1 Through collaboration with management partners during implementation planning, the following will be identified: key coral species, key reef sites, key watersheds, key erosion and sediment control practices and stormwater management practices, key coral reef fisheries taxa, key data gaps, and key marine protected areas. “Key” refers to a subset of sites and taxa on which the program will focus resources. Key fisheries taxa may include priority or indicator species or functional groups currently under management. Key marine protected areas will be limited to areas that are actively managed with fishing regulations or restrictions. Since good water quality is essential for a fully functioning coral reef ecosystem, watershed restoration practices and water quality stressors will also be identified. These are applicable to all strategies in this plan.

Time Frame and Implementation

Each strategy contains short-term (2-5 years) and mid-term (5+ years) objectives. For the near term, the plan will guide conservation investments to provide the best available science, tools, and strategies to inform management decisions.

Because of the slow-growing nature of coral reefs, changes at an ecological scale generally are not immediately observable. Realization of the measurable, long-term conservation goals is therefore set at 2040. Monitoring and observations will be used to inform the program when changes are necessary.

While this plan covers the breadth of the program's conservation activities, conservation and management regimes differ for the U.S. and international partners. Regional, three-year implementation plans will tailor specific activities to locations that can be tracked over the short term to meet intermediate results and objectives at local levels. Key sites and taxa will be identified to guide the development of these implementation plans for the Atlantic and Caribbean basin and the Pacific basin. Implementation will be done collaboratively within NOAA and with other partners, especially the state and territorial governments. The Coral Program will review and revise these plans every three years using adaptive management principles to track progress, and adjust course and the prioritization of resources, as needed, to meet long-term conservation goals.

CORAL REEF
CONSERVATION PROGRAM
STRATEGIC PLAN

Climate Pillar: Increase Resilience to Climate Change

The Coral Program is working with partners to assess and address the impacts of climate change, including ocean acidification on coral reef ecosystems, emphasizing a conservation approach that focuses on resilience-based management. Resilience refers to the capacity of a system to resist and recover from disturbance, and maintain structure and function to provide ecosystem services. Resilience-based management has recently been adopted as an effective approach for integrating climate change considerations into coral reef management by several international and domestic partners.

To support management partners in their quest to implement resilience-based management, this pillar focuses on three concepts: 1) an understanding of past, present, and projected future impacts to coral reefs caused by changing climate; 2) likely social and ecological responses to climate change; and 3) identification and prioritization of management actions to support ecosystem resilience and human well-being.

Strategy C1 – Support a resilience-based management approach

Objectives and Targets

- Support an ongoing dialogue with federal, state, territorial, and foreign government management partners on the resilience-based management approach and its benefits, and provide the necessary training and capacity on the resilience-based management principles and tools.
  - Target C1.1: By 2022, seven of the jurisdictions and/or foreign management partners have the technical capacity and management support to implement resilience-based management.

- Support the assessment of coral reef ecosystem vulnerabilities to the impacts of climate change, and use the assessment results to inform and support management actions.
  - Target C1.2: By 2022, seven management partners are making management decisions based on coral reefs' vulnerabilities to climate change.
- Support the collection, sharing, and integration of multiple types of monitoring and modeling to provide a dynamic understanding of the system to inform decisions and allow for adaptive management.
  - Target C1.3: By 2022, NOAA is collecting data and providing technical assistance to support the jurisdictions to integrate modeling and monitoring efforts, including status and trends monitoring, response monitoring, effectiveness monitoring, and reassessments of climate vulnerability.
- Support research at the international, national, and jurisdictional levels to answer key research questions to validate and improve the resilience-based management approach.
  - Target C1.4: By 2024, the top five Coral Reef Conservation Program prioritized research needs, identified by management partners, are conducted, and results are used to inform and implement resilience-based management.
- Support and encourage management partners to address potential climate change impacts in resilience-based management planning efforts.
  - Target C1.5: By 2025, seven of the jurisdictions and/or foreign management partners are applying climate resilience and vulnerability information to increase resistance to climate change disturbances and support recovery, integrating capacity building, monitoring, modeling, and research.

Key Partnership Opportunities

A partnership among NOAA's Coral Program, the Great Barrier Reef Marine Park Authority, The Nature Conservancy, SymbioSeas, the Coral Reef Unit of the United Nations Environment Programme, the Great Barrier Reef Foundation, and Reef Ecologic has been driving the adoption of resilience-based management for coral reef ecosystem management internationally. NOAA's continued engagement with partners (including the jurisdictions and the U.S. Coral Reef Task Force) will accelerate learning in this emerging approach to manage coral reefs in an uncertain future. NOAA will work to contribute and integrate its data, technical support, and capacity-building efforts with partners' initiatives.

Fisheries Pillar: Improve Fisheries Sustainability

Sustainable fisheries management under the Magnuson-Stevens Fishery Conservation and Management Act is an adaptive process that relies on sound science, innovative management approaches, effective enforcement, meaningful partnerships, and robust public participation. Sustainable fisheries play an important role in the nation's economy by providing opportunities for commercial, recreational, and subsistence fishing, and sustainable seafood for the nation. To support sustainable coral reef fisheries, the Coral Program is working closely with the fisheries management agencies of the seven jurisdictions, four regional fishery management councils, and NOAA Fisheries regional offices, as well as fostering engagement of fishers, local communities, and other key stakeholders.

The Fisheries pillar will

- Focus on key coral reef fisheries taxa ecologically important to reef condition and particularly vulnerable to overfishing;
- Fill key data gaps for fisheries managers, aiming to better understand fisheries sustainability that maintains ecological function of coral reef ecosystems, and promptly deliver data and results;
- Connect management partners with successful tools and strategies for adaptive management and sufficient enforcement and compliance; and
- Improve the way the program works, including increasing comparability and sharing of data, engaging more partners, and developing more effective communications products.

Strategies

F1 – Provide data essential for coral reef fisheries management

F2 – Build capacity for coral reef fisheries management

Strategy F1 – Provide data essential for coral reef fisheries management

Objectives and Targets

- Work with domestic partner agencies and organizations to increase comparability and exchange of visual census monitoring data, where appropriate, using the National Coral Reef Monitoring Program as a model to develop protocols, calibration factors, and indicators.
  - Target F1.1: By 2022, the Coral Program's fish monitoring data can be statistically compared with data from at least five partners' monitoring programs and shared in a way that managers would use.

- Support baseline and performance biological or socioeconomic assessments of key marine protected areas (MPAs) to better understand human perceptions and behaviors and realize ecological benefits.
  - Target F1.2: By 2024, 75 percent of key MPAs have baseline and performance assessments completed.
- Support and advocate for life history and ecological research, monitoring, and data integration to provide information on population status and ecology of key coral reef fisheries taxa and advance our understanding of ecological sustainability.
  - Target F1.3: By 2026, 75 percent of key coral reef fisheries taxa have completed stock or population assessments that inform current stock or population status and provide quantitative management advice.
- Encourage engagement of community and fishing partners in Coral Program-supported fisheries research and monitoring to incorporate more local and traditional knowledge into data collection and analysis and increase common understanding of the goals for and uses of fisheries-related data.
  - Target F1.4: By 2026, 50 percent of Coral Program fisheries research projects include engagement, participation, and cooperation with local stakeholders in development and implementation.
- Produce targeted outreach and communications products from the integration of existing biological and socioeconomic data, including the National Coral Reef Monitoring Program, to share examples of effective management approaches and public support with managers and policy makers.
  - Target F1.5: By 2026, 75 percent of key MPAs have various tools and products developed from biological and socioeconomic assessments and disseminated to relevant stakeholders.
- Identify assessment and decision-support tools, and provide training and technical assistance to fisheries and MPA managers to support fisheries management that contributes to ecosystem sustainability by considering ecological interactions and striving to maintain ecosystem function.
  - Target F1.6/F2.3: By 2029, Coral Program data and technical assistance have contributed to the body of science informing regulations relevant to key coral reef fisheries taxa in 100 percent of jurisdictions and councils.

Strategy F2 – Build capacity for coral reef fisheries management

Objectives and Targets

- Assist domestic and foreign partner agencies in prioritizing needs for fisheries and Marine Protected Area managers, such as ecosystem-based fisheries management, planning, monitoring, evaluation, and sustainable financing, and leverage tools and strategies to help meet those prioritized needs.
  - Target F2.1: By 2024, 50 percent of jurisdictions and/or foreign management partners are using management capacity-building tools developed cooperatively.[2]
- Assist domestic and foreign partner agencies to identify successful enforcement models and solutions and share information across the jurisdictions.
  - Target F2.2: By 2026, 50 percent of domestic and/or foreign partner agencies have adopted or implemented a new or improved approach to strengthen enforcement and compliance.
- Provide capacity-building tools, training, and technical support to fisheries and MPA managers to create enabling conditions for more ecologically sustainable fisheries management.
  - Target F2.3/F1.6: By 2029, Coral Reef Conservation Program data and technical assistance have informed regulations relevant to key coral reef fisheries taxa in 100 percent of jurisdictions and councils.

Key Partnership Opportunities

In addition to working closely with the relevant fishery management councils and agencies, the Coral Program may help ameliorate fishing impacts in key marine protected areas through partnerships with international, federal, state, and local agencies responsible for their management. Impacts include those caused by gear interactions and population depletion. Cooperation with other domestic monitoring and data collection programs to increase comparability and information sharing will be key to maximizing the utility of the Coral Program's data. The program will work more with local communities and fishing industry groups to benefit from their knowledge and expertise. Additionally, the program seeks to leverage expertise in building capacity in fisheries management and enforcement, as well as in social marketing and outreach to provide technical support to the jurisdictions and foreign government partners.

2 Specific management capacity-building tools will be identified as part of a process to work with fisheries and MPA management partners in prioritizing their capacity-building needs.

Pollution Pillar: Reduce Land-Based Sources

Land-based sources of pollution include sediment, nutrients, and other pollutants transported in surface waters, runoff, groundwater seepage, and atmospheric deposition into coastal waters.

The health of U.S. coral reef ecosystems depends on effective land use, water quality, and other resource management activities in adjacent coastal and upland regions. The Coral Program uses an integrated watershed management approach that includes comprehensive management plans to identify sources, baseline characterizations to understand the full suite of impacts, prioritized management responses, and detailed plans regarding partner roles and responsibilities.

The program will continue supporting the installation of best management practices. This pillar also provides technical assistance to support performance monitoring and assessments, capacity building, and multilateral coordination to advance watershed management efforts within the jurisdictions and, to a lesser extent, internationally. In addition, the Coral Program will provide technical assistance to support the Endangered Species Act and regional support for Essential Fish Habitat Consultations, because these federal mandates have a collective authority that strongly influences federal actions related to land-based sources of pollution.

Strategies

L1 – Develop, coordinate, and implement watershed management plans
L2 – Build and sustain watershed management capacity at the local level

Strategy L1 – Develop, coordinate, and implement watershed management plans

Objectives and Targets

- Collaborate and leverage resources with management partners to revise watershed management plans for key watersheds identified by the Coral Reef Conservation Program to address EPA's A-I criteria.[3]
  - Target L1.1: By 2024, 100 percent of the key watersheds have watershed management plans that address EPA's A-I criteria.
- Provide technical assistance and scientific support to management agencies to establish water quality targets for sediments and nutrients for key watersheds identified by the Coral Reef program.

3 U.S. Environmental Protection Agency (2013), *A Quick Guide to Developing Watershed Plans to Restore and Protect Our Waters*. Accessed at *www.epa.gov/sites/production/files/2015-12/documents/watershed_mgmnt_quick_guide.pdf*.

    - Target L1.2: By 2024, 50 percent of the key watersheds have water quality targets for sediments or nutrients appropriate for healthy coral reef habitats.
- Determine the efficacy of key erosion and sediment control practices and stormwater management practices to reduce sediment and nutrient loads through coordinated baseline and performance monitoring.
    - Target L1.3: By 2024, the efficacy of key erosion and sediment control practices and stormwater management practices to reduce sediments or nutrients is quantified.
- Support the implementation of watershed management recommendations within key watersheds to improve water quality and enhance coral reef ecosystem resilience.
    - Target L1.4: By 2029, sediment and nutrient loads meet established water quality targets for receiving coastal waters in >50 percent of the key watersheds.

Strategy L2 – Build and sustain watershed management capacity at the local level

Objectives and Targets

- Collaborate and leverage resources with management partners to strengthen local capacity to address the impacts of land-based pollution on nearshore coral reef ecosystems by having a watershed coordinator associated with each key watershed.
    - Target L2.1: By 2024, 100 percent of the program's key watersheds have coordinators.
- Foster management and nongovernmental partnerships to advance an integrated watershed management approach within the jurisdictions.
    - Target L2.2: By 2024, 50 percent of the program's key watersheds' priority management activities that improve water quality and enhance coral reef ecosystem resilience are implemented by jurisdictional partners in at least one key watershed per jurisdiction.
- Strengthen management partners' technical and financial capacities to achieve financial independence to implement priority watershed management activities to improve water quality and enhance coral reef ecosystem resilience.
    - Target L2.3: By 2024, the ratio of funding (external partner funds to Coral Program funds) is greater than 1:1 for implementing priority watershed management activities that improve water quality and enhance coral reef ecosystem resilience within key watersheds in at least one key watershed per jurisdiction.

Key Partnership Opportunities

The Coral Program will continue engaging with the U.S. Coral Reef Task Force through its Watershed Partnership Initiative to enhance coordination and partnerships, and seek to increase contributions of agencies' resources and expertise to implement geographically specific and integrated activities to reduce pollutant loads to coral reef ecosystems. This initiative also promotes consistent and strengthened application and enforcement of existing laws and authorities intended to address land-based sources of pollution that threaten the health of coral reefs. In addition, the Coral Program will pursue collaborations and partnerships with agencies that have appropriate mandates to establish water quality targets and support actions to reduce sediments and nutrients deleterious to the health of coral reefs. The Coral Program will also continue to incorporate watershed best management practices into the resilience-based management framework, domestically and internationally.

Restoration Pillar: Restore Viable Coral Populations

Saving coral reefs requires a multi-pronged approach. Direct and ecologically informed interventions at the local level are needed to keep coral reef ecosystems viable and functioning. Local stressors such as the loss of herbivorous species (e.g., sea urchins and grazing fish), invasive species, chronic anchoring impacts, and vessel groundings need to be addressed locally, with simultaneous efforts to focus on repopulating key reefs. Active and targeted coral repopulation, using novel ecological interventions (e.g., stress hardening and assisted gene flow), will facilitate adaptation of coral reef ecosystems to evolving environmental conditions.

Restoration is one approach that specifically addresses building and maintaining resistance and resilience to threats and will drive recovery of the ecosystem. This pillar will support necessary research, implement on-the-ground actions to prevent additional losses of corals and their habitat, and apply innovations in restoration and intervention techniques to create resilient, genetically diverse, and reproductively viable populations of key coral species. Additionally, the Coral Program will improve the use of regulatory mandates to prevent loss of coral and coral reef habitat through supporting technical knowledge transfer to permitting agencies, encouraging consistent use of best management practices, and informing mitigation options with appropriate restoration techniques.

Strategies

R1 – Improve coral recruitment habitat quality
R2 – Prevent avoidable losses of corals and their habitat
R3 – Enhance population resilience
R4 – Improve coral health and survival

Strategy R1 – Improve coral recruitment habitat quality

Objectives and Targets

- Support research and development of effective and efficient herbivore propagation techniques, which can be operationalized to replenish these wild populations.
  - Target R1.1: By 2022, 80 percent of restoration projects identify and achieve retention rates of herbivores at key reef sites.
- Support and encourage the implementation of herbivore replenishment activities to achieve a reduction of algal cover.

- Target R1.2: By 2024, algal cover is reduced and maintained at predetermined levels at key reef sites.

- Support research and development of control techniques for invasive (e.g., algae) and nuisance species that compete for coral recruitment habitat.
  - Target R1.3: By 2022, pilot removal projects achieve management-identified percent reductions in cover of invasive and nuisance species at key reef sites.
- Support and encourage the implementation of control techniques for invasive and nuisance species.
  - Target R1.4: By 2024, management-identified percent key cover of invasive and nuisance species is achieved at key reef sites.

Strategy R2 – Prevent avoidable losses of corals and their habitat

Objectives and Targets

- Identify high-risk areas, and develop and implement plans to reduce the impact of physical damage from vessel groundings and anchors.
  - Target R2.1: By 2024, there is a 25-percent reduction of reports of instances of maritime-based damage in high-risk areas where plans are implemented.
- Support emergency response to and restoration of areas impacted by physical events (e.g., vessel groundings, hurricanes) in high-value areas (e.g., areas of high coral cover).
  - Target R2.2: By 2022, restoration activities are undertaken at 50 percent of all known physical disturbance events that require restoration where capacity exists, annually.
- Support use of existing, and creation of new, mechanisms for enforcement and recovering damages from parties responsible for a physical damage event.
  - Target R2.3: By 2024, increase the percentage of cases pursued that are successfully resolved to the benefit of the resource from incidents of reef damage.

Strategy R3 – Enhance population resilience

Objectives and Targets

- Continue to build domestic and foreign partnerships, while leveraging the network of the Coral Reef Consortium,[4] to conduct restoration projects at ecologically meaningful scales.
  - Target R3.1: By 2024, the Coral Reef Consortium produces a series of "best-practice" and "scaling-up" guidance documents within the following specific areas

4 The Coral Restoration Consortium is composed of scientists, managers, coral restoration practitioners, and educators dedicated to fostering collaboration and technology transfer among participants, and to facilitating scientific and practical ingenuity to demonstrate that restoration can achieve meaningful results.

of restoration practice and science: land-based propagation, in-water propagation, larval propagation, outplanting, monitoring, restoration as coastal protection, and restoration genetics.

- Support research and development of innovative resilience interventions (e.g., stress-hardening corals, assisted migration and gene flow, manipulation of symbiotic partnership) to conduct low-risk pilot projects.
  - Target R3.2: By 2023, NOAA and partners have pilot projects underway for at least four interventions identified as high priority, recommended, and ready for testing according to the National Academy of Sciences review, "Interventions to Increase the Resilience of Coral Reefs."[5]
- Support research and development of larval propagation techniques to significantly reduce post-settlement mortality of coral recruits.
  - Target R3.3: By 2024, proven techniques exist to increase post-settlement survival of larval-reared corals to warrant moving forward with demonstration projects.
- Support implementation of larval coral propagation projects that incorporate resilience and post-settlement survival techniques at key reef sites.
  - Target R3.4: Within 5-7 years of proving techniques to increase post-settlement survival, small-scale projects are implemented that demonstrate both restoration success and resilience to stress events.
- Facilitate implementation of asexual and sexual propagation techniques at regional to ecosystem scales at key reef sites.
  - Target R3.5a: Between 2019 and 2029, the average annual rate of efficiency in nursery-assisted, asexual reproduction techniques increases.
  - Target R3.5b: Between 2019 and 2029, the average annual percentage of nursery-assisted, sexual recruits surviving to sexual maturity increases.

5 The National Academy of Sciences is currently conducting a study, and once completed, it will inform the activities associated with this objective.

Strategy R4 – Improve coral health and survival

Objectives and Targets

- Support research and development of control techniques for coral diseases and corallivores.
  - Target R4.1: By 2024, at least one new control technique for both disease and corallivore control is developed and demonstrated to be effective at the scale of key reef sites.
- Implement control techniques at the appropriate scale to prevent additional losses of corals.
  - Target R4.2: By 2029, projects will work to reduce disease incidence or corallivore prevalence to natural levels at 50 percent of key reef sites.

Key Partnership Opportunities

The Coral Program will require the assistance of numerous partners to realize the objectives of these restoration and resilience strategies. The Coral Restoration Consortium is a primary partner, because its membership spans the various disciplines and expertise required. To research and develop the various techniques, the Coral Program will engage academia, nongovernmental organizations, and private industry. For example, in early 2018 the National Academy of Sciences began a 24-month review, "Interventions to Increase the Resilience of Coral Reefs," and the results may help inform coral restoration activities. Implementation of restoration techniques at ecologically meaningful scales will also require partnership with restoration practitioners, private foundations, and federal and local management agencies (e.g., the U.S. Coral Reef Task Force), as well as less traditional partners in engineering and technology development.

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About the Coral Reef Conservation Program

Established in 2000, the Coral Reef Conservation Program fulfills NOAA's responsibilities under the Coral Reef Conservation Act and Presidential Executive Order 13089 on Coral Reef Protection.

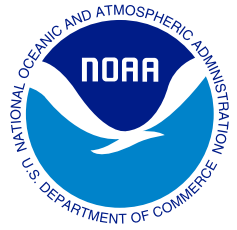
The program brings together expertise from across NOAA for a multidisciplinary approach to study these complex ecosystems and inform effective management activities. Our work involves NOAA scientists in the National Ocean Service, National Marine Fisheries Service, Office of Oceanic and Atmospheric Research, and National Environmental Satellite, Data, and Information Service.

Multidisciplinary collaboration is critical to coral reef conservation because the threats to coral reefs are numerous and synergistic. Effective collaboration also enables NOAA to uphold its other mandates to protect and conserve trust resources, including Endangered Species Act-listed species and their critical habitats, essential fish habitats mandated under the Magnuson-Stevens Fishery Conservation and Management Act, and underwater parks designated under the National Marine Sanctuaries Act and executive orders.

The Coral Program's multidisciplinary approach includes topic-based research, monitoring, mapping, social science, communications, and capacity building at local, national, and international scales. This crosscutting work provides the necessary information and enabling conditions for effective coral reef conservation and management. The backbone of the Coral Program's monitoring efforts is the National Coral Reef Monitoring Program, which documents U.S. coral reef ecosystem status and trends. This program is a strategic framework for conducting sustained observations of biological, climatic, and socioeconomic indicators in U.S. states and territories in a consistent and integrated manner. This broad-scale monitoring in turn provides context for interpreting the results of localized monitoring. Inherent to all monitoring, assessment, and data-integration activities of the Coral Program is a sustained data management effort, including a formal archive of all the data collected.

The Coral Program also partners with other federal managers, state and territorial governments, academic institutions, nongovernmental organizations, foreign governments and organizations, and community groups to implement actions to address local issues that impact coral reef ecosystems. This work always has an eye toward understanding how warming ocean temperatures and increased ocean acidity, among other phenomena, will impact reefs. Partnerships are essential to design and implement effective management and conservation solutions that span local, state, and federal authorities.

To learn more, visit *coralreef.noaa.gov.*



Coral Reef Conservation Program

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