
Florida Reef Tract Coral Disease Outbreak FAQ

How important are Florida coral reefs for economic and environmental benefits?

Coral reefs are truly natural treasures. They are one of the most diverse and complex marine ecosystems on Earth – the quintessential rain forests of the sea. The Florida Reef Tract (FRT) stretches for more than 330 miles along Florida’s southeast coast from Martin County to the Dry Tortugas. As the only reef in the continental U.S., it is the crown jewel of Florida’s coastal treasures, and home to countless reef-building corals, gorgonians, sponges, fish, algae and invertebrates.

Coral reefs provide the foundation for 71,000 jobs and \$6.3 billion in sales and income in South Florida. South Florida’s economy and its way of life are inextricably linked to the coral reef ecosystem. Coral reefs provide many goods and services for South Florida, such as coastline protection from storms and flooding – including hurricanes – and habitat for many important species of commercial and recreational fisheries. They are also a major driver of tourism, offering recreational opportunities for snorkeling and scuba diving.

How do the local reefs help protect against hurricane damage?

Coral reefs serve as the first line of defense for Southeast Florida’s coastline. Healthy, resilient coral reefs safeguard against extreme weather. Coral reef structures reduce wave energy, which helps protect coastlines and valuable infrastructure from big waves and storm surge. Check out The Nature Conservancy’s [Mapping Ocean Wealth](#) website and see just how much [Florida’s reefs protect our shorelines](#).

How long has the current coral disease outbreak been active?

Beginning in 2014, an outbreak of [Stony Coral Tissue Loss Disease \(SCTLD\)](#) started offshore of Miami-Dade County; it is unique in that it has continued unabated for more than four years. Since 2015, the Florida Department of Environmental Protection’s Office of Resilience and Coastal Protection – Southeast Region has led the coordination of numerous partners in an open and collaborative multi-faceted disease investigation and response effort. Partners include federal, state and local governments, universities, nongovernmental organizations, and the South Florida community. In 2018, the [Florida Fish and Wildlife Conservation Commission \(FWC\)](#) and [National Oceanic and Atmospheric Administration \(NOAA\)](#) officially joined DEP in managing the collective disease response effort. In 2019, the [National Parks Service \(NPS\)](#) joined in this collaborative effort.

While past disease outbreaks have subsided during the cooler winter months, this disease has continued with no indication of seasonality and without any interruption from Hurricane Irma or other storm events.

What is the geographic extent of this disease outbreak? How many corals are affected?

As of 2018, more than half of the 330-mile Florida Reef Tract has been affected – approximately 90,000 acres from Martin County to the Lower Florida Keys. SCTLD is impacting over half of the reef-building coral species. Up to 66 percent to 90 percent of the certain susceptible coral species population (see list below) are infected; based on the area affected and the known density of corals across the habitats in this area, it is estimated that hundreds of millions of reef-building (i.e. stony) coral colonies have been affected. Please refer to Figure 1 below for the most up-to-date map of the

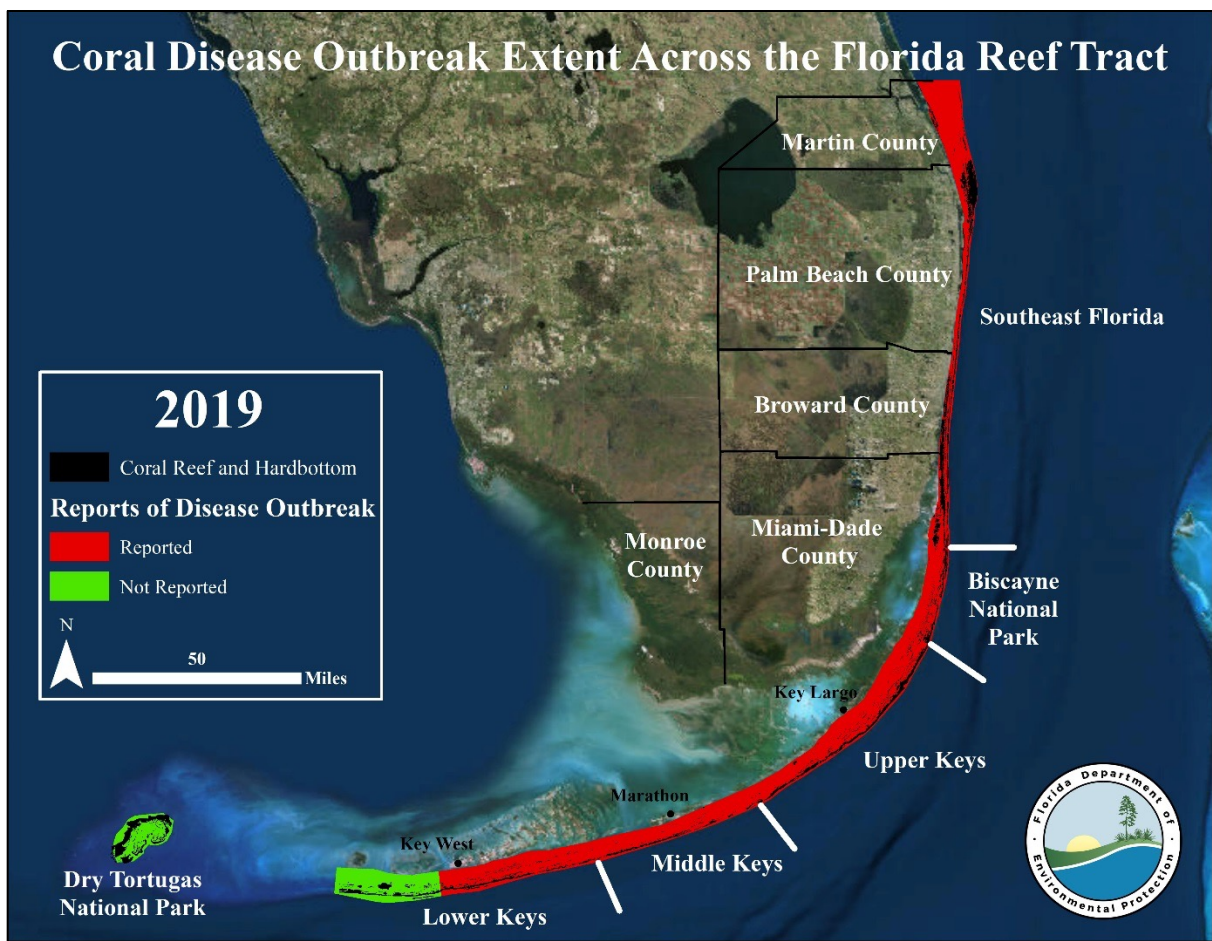


Figure 1: Current spatial extent of coral disease across the Florida Reef Tract.

How fast are corals being affected? Do affected corals ever show signs of recovery?

Studies have shown the disease pathogen can be transmitted through the water column or from one coral touching another coral. The spread of the disease was relatively fast and believed to have generally followed the prevailing water current patterns – moving rapidly north with the Gulf Stream and slowly south (presumably in coastal eddies) into Biscayne National Park and the Florida Keys. However, it affected nearshore and offshore reefs at different times, so researchers are trying to identify why that occurred.

Once disease signs are observed on a colony, the more susceptible species are killed within weeks to months; less susceptible species may succumb in months or a year. Observations show that once a coral is infected, the disease usually kills the entire colony; however, new reports have shown that some of the larger colonies have been successful in fighting off some infections. This gives us great hope that if we can reduce the known stressors to the corals, they may have more energy to fight off the disease.

Interestingly, since mid-2018, monitoring reports have shown a slight slowdown in the spread of disease, both in its progression down the Florida Reef Tract and across individually affected colonies. The cause of this slowed disease progression is currently unknown. Reef managers and scientists are unsure if it will revert to rates previously observed, but currently this has led to (previously uncommon) partial colony mortality on some species in the Florida Keys. The leading boundary and individually affected colonies are being monitored regularly while other priority response activities continue.

What species are affected? Are some more at-risk than others?

Nearly half of Florida's 45 reef-building coral species have reportedly been affected. Species are categorized as highly susceptible (colonies experience very rapid tissue loss), intermediately susceptible (colonies experience somewhat slower tissue loss), or of unknown susceptibility (species that have been reported with disease but there is insufficient data to categorize susceptibility). In the following lists, asterisks indicate a species listed under the Endangered Species Act.

Highly susceptible:

Colpophyllia natans (Boulder brain coral)
Dendrogyra cylindrus (Pillar coral)*
Dichocoenia stokesii (Elliptical star coral)
Diploria labyrinthiformis (Grooved brain coral)
Eusmilia fastigiata (Smooth flower coral)

Meandrina meandrites (Maze coral)
Pseudodiploria strigosa (Symmetrical brain coral)
Pseudodiploria clivosa (Knobby brain coral)

Intermediately susceptible:

Montastraea cavernosa (Great star coral)

Orbicella annularis (Lobed star coral)*

Orbicella faveolata* (Mountainous star coral)

Orbicella franksi* (Boulder star coral)

***Siderastrea siderea* (Massive starlet coral)**

***Solenastrea bournoni* (Smooth star coral)**

***Stephanocoenia intersepta* (Blushing star coral)**

Unknown susceptibility:

Agaricia agaricites (Lettuce coral)
Agaricia fragilis (Fragile saucer coral)
Favia fragum (Golfball coral)
Helioseris cucullata (Sunray lettuce coral)
Isophyllia rigida (Rough star coral)

Isophyllia sinuosa (Sinuous cactus coral)
Madracis arenterna (Pencil coral)
Mussa angulosa (Spiny flower coral)
Mycetophyllia spp. (Cactus corals)*
Scolymia spp. (Disk corals)

Overall, we are seeing a decline in the population of the susceptible species. In fact, some of the highly and intermediately susceptible species have disappeared from certain long-term monitoring sites, though we now know there are survivors of those species across the Florida Reef Tract.

Among the most impacted species are *Dendrogyra cylindrus* (pillar coral), *Dichocoenia stokesii* (elliptical star coral), and *Meandrina meandrites* (maze coral). Some of the most important reef-building species have also been affected, including *Colpophyllia natans* (boulder brain coral), *Montastraea cavernosa* (great star coral) and *Siderastrea siderea* (massive starlet coral).

What is the difference between this disease and coral bleaching? Is this disease related to the global coral bleaching event that occurred between 2014 and 2017?

Corals only thrive within a relatively narrow range of water clarity, salinity and temperature conditions. Their health also depends on the presence of herbivores (fish and urchins) and apex predators (sharks, groupers and other big fish), which collectively keep the reef free of excess harmful algae and in balance with local nutrients.

Unfortunately, these conditions are being compromised on reefs around the globe, and Florida is no exception. Most corals don't tolerate stress very well – coral bleaching and coral disease are the resulting stress responses. Coral bleaching is the equivalent of corals being in the intensive care unit at a hospital. Bleaching occurs when corals are so stressed that they expel the colorful algae (called zooxanthellae) that live symbiotically in their cells, causing the coral's white skeleton to show through their still-living translucent tissue. Since corals rely on these algae as their primary source of nutrition and energy, without them they are severely weakened. In this weakened state, they are more susceptible to disease and death; but, if the stress removed, they can bring back their algae and fully recover in a few years.

In contrast, coral disease is when a pathogen (or, pathogens) attacks a coral colony and kills the living tissue, leaving only bare white skeleton behind. Coral diseases often are differentiated by appearance– for example, some are associated with colored bands or discolored tissue. SCTL does not show these

signs, instead manifesting as different patterns of rapid tissue loss – hence the name Stony Coral Tissue-Loss Disease.

Globally, a significant increase in the frequency and severity of extreme thermal events has led to massive coral die offs around the world. Reports have shown that corals near Miami were infected with SCTLD prior to the 2014-2017 global bleaching event; however, those consecutive years of increased thermal stress and extensive bleaching likely weakened the corals' resilience potential and amplified the lethal nature of SCTLD.

Has the disease agent affecting South Florida coral reefs been identified? What are the causes of this epidemic?

Coral reef and disease scientists are studying tissue samples (i.e. biopsies) to try to identify potential pathogens. Unfortunately, the disease agent(s) has not yet been identified, though antibiotics have been effective in combating disease progression in certain instances. Rather than a distinct disease agent, multiple factors or pathogens can contribute to coral disease, making the definitive causes of any coral disease outbreak challenging to determine. Investigation into the potential causes of the SCTLD outbreak is ongoing.

After four years, why is there no knowledge of the types of disease or a possible solution for the outbreak?

Coral disease investigations are tremendously complicated. Generally, many factors and co-factors ultimately contribute to disease rather than a distinct agent, so that the definitive causes may remain largely unknown for years. Additionally, while human health and disease management have advanced rapidly in recent years, knowledge about coral diseases and control options are far less advanced. Despite the complications inherent with coral disease investigations, significant progress over the past four years in knowledge and treatment has been made about SCTLD. However, our coral disease experts have cautioned that while we should continue pathogen identification research, our efforts should focus on intervention and rescue actions that save priority corals in the short-term.

The large, collaborative response to this singular disease event has been unprecedented, with a great deal of expertise and in-kind and financial resources contributed by various partners.

What specific response efforts have been undertaken thus far?

DEP, FWC and NOAA are co-leading a multi-faceted, collaborative response effort in coordination with the partners listed below. In July 2018, 10 response teams were established for priority focus areas such as disease research, intervention tool development and testing, coral rescue, regulatory compliance, citizen engagement, and community outreach. Members from each of the response teams meet frequently to discuss next steps, provide technical feedback on

projects and proposals, and identify synergies across projects. Since 2017, DEP has been allocated more than \$3 million to fund priority research associated with offshore water quality conditions and response to the ongoing SCTL outbreak. DEP funds have been used for priority response actions such as:

- Strategically sampling, analyzing and experimenting to better understand the disease dynamics and attempt to identify a pathogen (or pathogens);
- Investigating whether changes in environmental conditions may have caused or contributed to the outbreak;
- Exploring and deploying in-water management interventions to try to slow or stop the continued spread of coral disease;
- Rescuing susceptible corals that haven't been infected to propagate them for future restoration;
- Locating survivors of susceptible species and propagating them.

Response partners also have been working to engage and inform the public in Florida and the wider Caribbean about SCTL and what actions can be taken to help. DEP has created programs like the [Coral Reef Ambassador Program](#) and the [Southeast Florida Action Network \(SEAFAN\)](#) to involve the community in the collective coral disease response. Please visit www.SEAFAN.net to submit your observations of coral disease on Florida's reefs.

Still, the immediate intervention and rescue actions are strictly triage; those efforts alone won't ensure long-term survival of our corals if we don't address why they died in the first place. We urgently need to reduce local stressors and reestablish the correct environmental conditions offshore so our reefs can be healthy again. Reducing land-based sources of pollution, incompatible fishing practices and fishing pressure, and eliminating impacts from vessel groundings, dragged anchors and marine debris have long been advocated by the [Florida Reef Resilience Program](#), with support from the [National Oceanic and Atmospheric Administration's \(NOAA\) Coral Reef Conservation Program](#). Priority actions include, but are not limited to:

- Reducing nutrient pollution (nitrogen and phosphorus) to coastal waters (e.g., upgrading urban wastewater and stormwater infrastructure).
- Reducing algae by managing for adequate populations of herbivores, predators and other reef-dependent species.
- Minimizing turbidity, sedimentation and direct physical injury associated with coastal construction.

What organizations are working on the collective disease outbreak response?

DEP, FWC and NOAA are working with dozens of partners from federal, state and local agencies, non-governmental organizations, universities, and members of the community to research and respond to this problem. Partners currently include but are not limited to:

Broward County

- Environmental Protection and Growth Management Department

Coral Restoration Foundation

U.S. Environmental Protection Agency

Florida Aquarium

Florida Atlantic University

- Harbor Branch Oceanographic Institute

Florida Department of Environmental

Protection

- Office of Resilience and Coastal Protection
- Florida Parks Service

Florida Fish and Wildlife Conservation

Commission

- Fish and Wildlife Research Institute

Florida Institute of Technology

Florida International University

Florida Keys Community College

FORCE BLUE, Inc.

Friends of Our Florida Reefs

George Mason University

National Oceanic and Atmospheric Administration

- Coral Reef Conservation Program
- National Marine Fisheries Service
- Coral Disease and Health Consortium
- Florida Keys National Marine Sanctuary
- Office of Coastal Management

National Park Service

- Biscayne National Park
- Dry Tortugas National Park

South Florida/Caribbean Network

National Science Foundation

Nova Southeastern University

- Halmos College of Natural Sciences and Oceanography/ National Coral Reef Institute

Oregon State University

Palm Beach County

- Division of Environmental Resource Management

South Florida Regional Planning Council

Southeast Florida Coral Reef Initiative

Smithsonian Institution

Keys Marine Laboratory

Martin County

- Public Works

Miami-Dade County

- Division of Environmental Management

Monroe County

Mote Marine Laboratory

The Nature Conservancy

Treasure Coast Regional Planning Council

United State U.S. Geological Survey

- National Wildlife Health Center

University of Florida

University of Hawaii

University of Miami

- Rosenstiel School of Marine and Atmospheric

Science

University of South Florida



Is there hope for our corals?

Absolutely! While the condition is urgent, and timing is of the essence, it isn't too late to save this incredibly important ecosystem. Reefs are resilient if given the chance and the enabling conditions for their growth and survival. The key is reducing the local stressors that we can control through careful planning and appropriate investment that helps to re-create the enabling conditions that support their reproduction, growth, and survival.

Additionally, the collaborative partner efforts undertaken in Florida are now at the forefront of global disease research and response. The knowledge gained through this collaborative effort – from disease treatments and genetic rescue to community engagement opportunities and disease-relevant restoration planning – not only will help save Florida's coral reefs but will be instrumental to inform future coral disease outbreak response activities around the world.

It is also worth noting that while roughly half of Florida's coral species are impacted by this disease, half are not – and some of those species not impacted have even increased in prevalence on reefs. Two species of great importance to the entire Atlantic/Caribbean basin – staghorn coral (*Acropora cervicornis*) and elkhorn coral (*Acropora palmata*) – are not known to be affected and are still the focus of the groundbreaking propagation and outplanting efforts that make Florida a leader in coral reef restoration.

Furthermore, even on reefs that have been within the disease outbreak area for years, there are many survivors, including colonies of some of the most impacted species. Given their incredible resilience and survival against multiple stressors over the years, these corals may be among the most important corals in the world for future restoration efforts.

Stay engaged. Please visit the DEP and NOAA coral disease response websites to stay up to date on the latest response efforts and new opportunities to get involved.

- <https://floridadep.gov/fco/coraldisease/>
- <https://floridakeys.noaa.gov/coral-disease/>