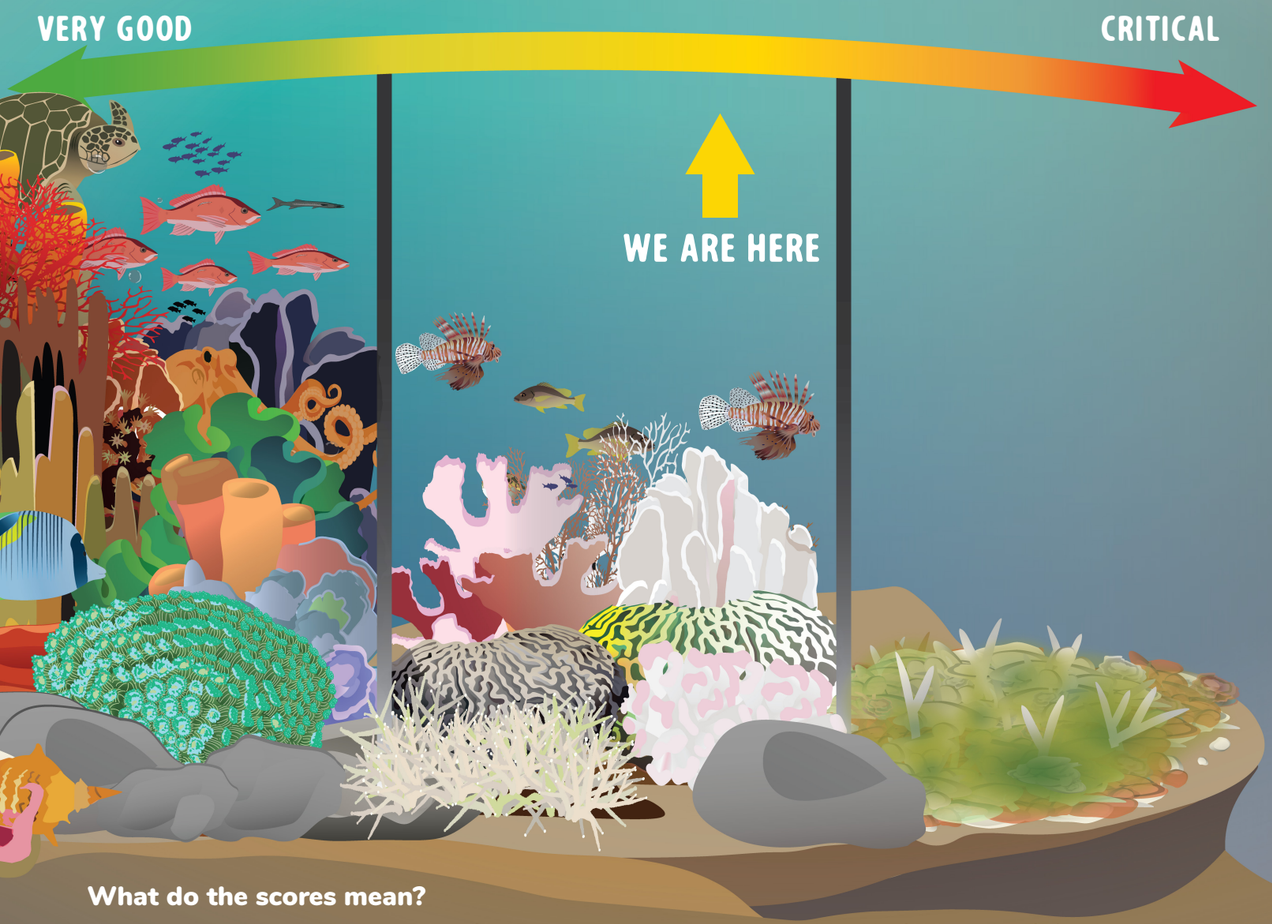
Coral reef condition: A status report for

U.S. CORAL REEFS

NOAA
CORAL REEF
CONSERVATION PROGRAM

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

U.S. CORAL REEFS ARE **IN FAIR CONDITION, BUT ARE VULNERABLE AND DECLINING**



What do the scores mean?

The colors below designate the condition of indicators used to measure the overall health of U.S. coral reefs (see basin wheels to the right). U.S. coral reefs were scored based on indicators within four major themes: **Corals & Algae** make up the base of the coral reef ecosystem, providing food and shelter for fish and other reef creatures; **Fish** are key to healthy reefs, coastal economies, and the livelihoods of local communities; **Climate**, especially temperature and ocean chemistry, indicate the level of environmental stress to the reef (changing climate conditions can vary on both regional and local levels); **Human Connections** to coral reefs help gauge local support for reef management, conservation, and community engagement.

90–100% Very Good

All or almost all indicators meet reference values. Conditions in these locations are unimpacted, or minimally impacted or have not declined. Human connections are very high.

80–89% Good

Most indicators meet reference values. Conditions in these locations are lightly impacted or have lightly declined. Human connections are high.

70–79% Fair

Some indicators meet reference values. Conditions in these locations are moderately impacted or have declined moderately. Human connections are moderate.

60–69% Impaired

Few indicators meet reference values. Conditions in these locations are very impacted or have declined considerably. Human connections are lacking.

0–59% Critical

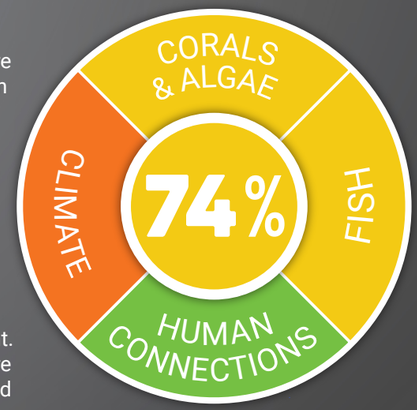
Very few or no indicators meet reference values. Conditions in these locations are severely impacted or have declined substantially. Human connections are severely lacking.

REEF DEGRADATION CONTINUES

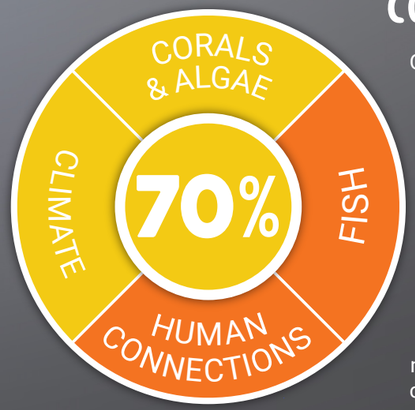
Pacific and Atlantic data from 2012–2018 indicate that U.S. coral reefs are in fair condition. Most themes did not meet their historical references, meaning they are moderately to very impacted. There are exceptions, but overall, the data suggest that reefs are vulnerable to further decline due to threats from ocean warming and acidification, coral disease, and fishing impacts. Residents from all coral reef jurisdictions who took the human connections surveys believe coral reef conditions have generally declined over the past decade, and they lack optimism about future conditions. If we do little to protect and conserve coral reefs, they will continue to decline and more reefs will receive impaired scores in the future. Luckily, there are many actions we can take to turn the tide on coral reef degradation. Human connections surveys indicate that support for management is relatively high. Support for management, including protecting reefs, reducing pollution, and increasing reef restoration, is a start, especially at the local level. Globally, climate actions are necessary to reduce greenhouse gas emissions and slow the warming of ocean waters. Conservation cannot be achieved without an informed and engaged public; human connections to reefs can always be strengthened, even in places that already have high human connection scores. Communities, and their support for management, are a major component to improving the trajectory of coral reef conditions.

CORAL REEFS IN THE PACIFIC

Overall, Pacific reefs are in fair condition. The U.S. jurisdictions that were included in this score include the Main Hawaiian Islands, the Northwestern Hawaiian Islands, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, and the Pacific Remote Islands. Climate indicators are impaired. Frequent and severe heat stress has led to coral bleaching and mortality, and water chemistry is becoming less suitable for reef material growth because of ocean acidification. Overall, corals & algae are fair, but this represents a range of degraded to pristine reefs throughout the Pacific. Degradation is attributable to both local impacts as well as global climate change. Fish indicators are fair, which in part reflects the inclusion of reefs in remote areas that are not subjected to fishing pressure. Fish in populated areas, conversely, are less abundant. Human connections to coral reefs are good: residents are moderately aware of coral reef threats, show moderate support for coral reef management, and demonstrate high engagement in pro-environmental behaviors.



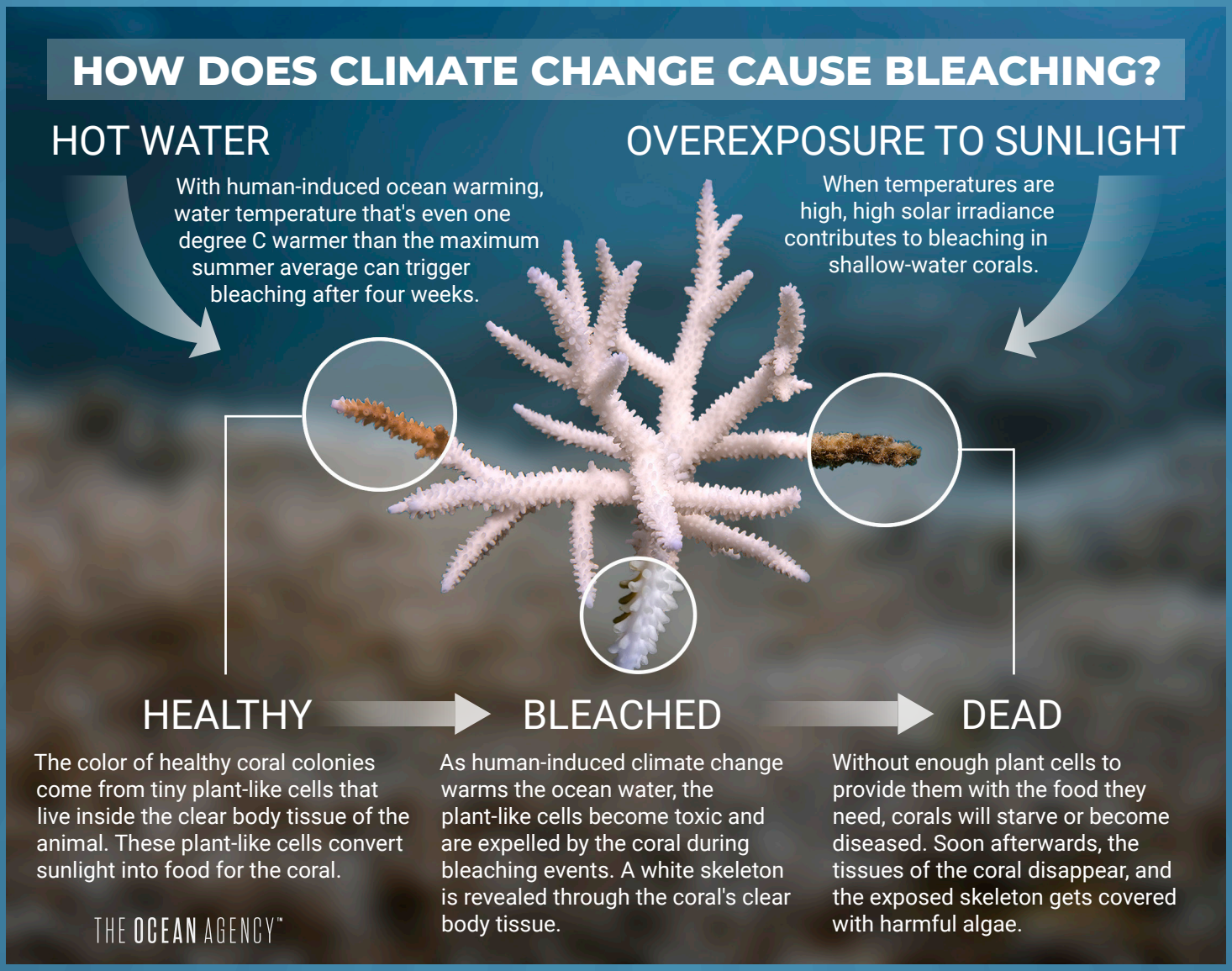
CORAL REEFS IN THE ATLANTIC



Overall, Atlantic reefs are in fair condition but are on the cusp of being impaired. The U.S. jurisdictions that are included in the Atlantic score are Florida, the U.S. Virgin Islands, Puerto Rico, and Flower Garden Banks. Corals & algae are fair but declining. While the climate score is fair, many reefs are experiencing habitat loss. Additionally, fish populations are experiencing fishing impacts. The removal of commercially and recreationally important fishes from the reefs is not sustainable for future populations. Atlantic and Caribbean corals are also experiencing a multi-year outbreak of Stony Coral Tissue Loss Disease (SCTLD), an infection unique for its geographic range, rapid progression, and high mortality rate. Researchers are working to identify potential pathogens. Human connections are impaired. Residents demonstrate moderate support for coral reef management but have limited awareness of coral reef threats and rarely engage in pro-environmental behaviors.

CLIMATE CHANGE IS IMPACTING EVERY CORAL REEF

No matter how remote, climate change threatens every U.S. coral reef. From 2014 to 2017, an unusually long global marine heatwave caused bleaching and mortality events from Guam to the U.S. Virgin Islands. Since then, bleaching has become more frequent. Forecasting models of bleaching unanimously show the frequency and intensity of these events will continue to accelerate, even under optimistic carbon emission reduction scenarios. Additionally, ocean acidification is occurring because seawater is absorbing carbon dioxide from the atmosphere, leading to lower pH and greater acidity.



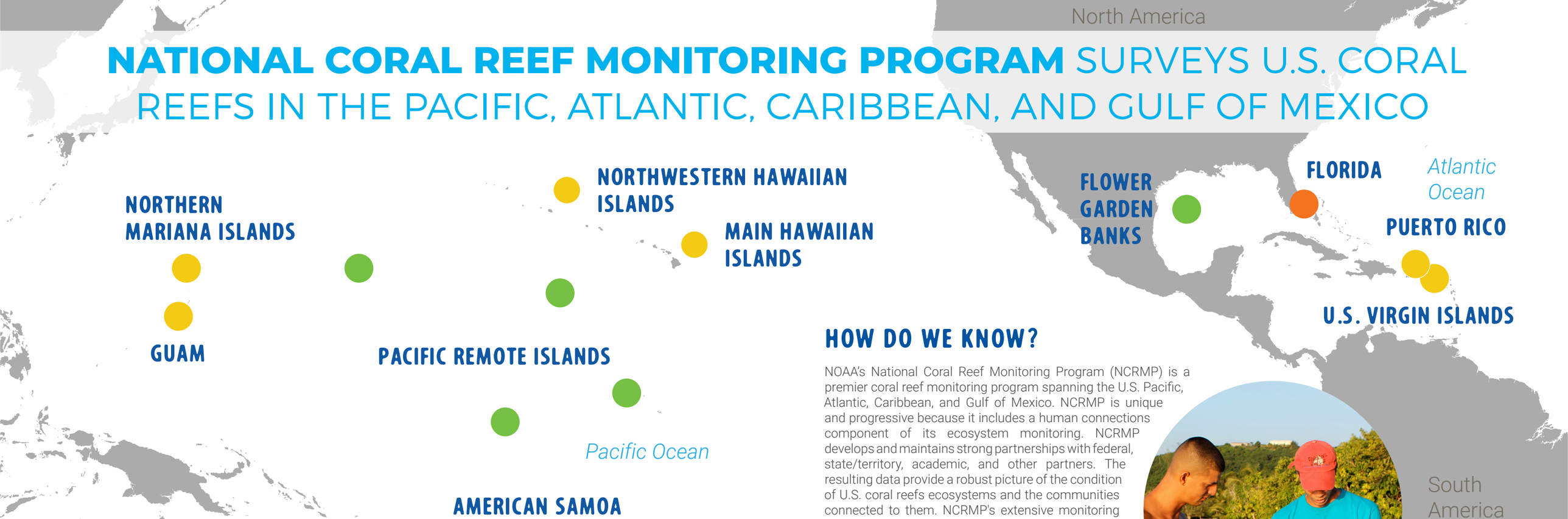
TO SAVE CORAL REEFS, WE NEED TO CUT CARBON EMISSIONS

Local efforts to enhance reef resilience and restore reefs are important to help reefs survive the impacts of human-induced climate change. However, those efforts must be coupled with transitioning away from fossil fuels towards more renewable sources of energy. Three U.S. coral reef jurisdictions have plans to switch to 100% renewable energy by 2050 or sooner (Hawai'i, American Samoa, Puerto Rico), and three have partial renewable energy standards (Guam, CNMI, U.S. Virgin Islands). Other strategies such as shielding corals, especially those in nurseries, from excess sunlight could also help prevent bleaching events during this period of transition.

OCEAN ACIDIFICATION IS CAUSING REEF EROSION

Ocean acidification is slowing coral growth rates and accelerating the loss of reef structure. Corals make their skeletons by combining calcium and carbonate from seawater. As the ocean becomes slightly more acidic, meaning the ocean pH gets lower, it becomes harder for calcifying corals to build and maintain their skeletons. If the pH gets too low, skeletons can even begin to dissolve or erode. Throughout the Caribbean and Florida, many reefs are already eroding, whereas in the Pacific reef growth still generally outpaces erosion. If we don't reduce global fossil fuel emissions, more reefs will erode in the future.

NATIONAL CORAL REEF MONITORING PROGRAM SURVEYS U.S. CORAL REEFS IN THE PACIFIC, ATLANTIC, CARIBBEAN, AND GULF OF MEXICO



What's the score for each U.S. coral reef system?

All U.S. coral reef jurisdictions are listed below, underneath the overall score of their respective status. The National Coral Reef Monitoring Program has published individual status reports for each of these jurisdictions, where their calculated score and related stories are explored with greater depth. To view any or all of these status reports, please visit https://www.coris.noaa.gov/monitoring/status_report/, where digital copies of these reports are freely available to the public. To understand what each score designation means, please refer to the section "What do the scores mean?" located under the "Reef Degradation" diagram.

Good	Fair	Impaired
• American Samoa	• Guam	• Florida
• Flower Garden Banks	• Main Hawaiian Islands	
• Pacific Remote Islands	• Northern Mariana Islands	
	• Northwest Hawaiian Islands	
	• Puerto Rico	
	• U.S. Virgin Islands	

HOW DO WE KNOW?

NOAA's National Coral Reef Monitoring Program (NCRMP) is a premier coral reef monitoring program spanning the U.S. Pacific, Atlantic, Caribbean, and Gulf of Mexico. NCRMP is unique and progressive because it includes a human connections component of its ecosystem monitoring. NCRMP develops and maintains strong partnerships with federal, state/territory, academic, and other partners. The resulting data provide a robust picture of the condition of U.S. coral reefs ecosystems and the communities connected to them. NCRMP's extensive monitoring covers four main themes—benthics (corals & algae), fish, climate, and human connections—which are priority topic areas for the coral reef conservation community. For the inhabited jurisdictions, a subset of the population is surveyed every seven years to answer the question: What is the status of human knowledge, attitudes, and perceptions regarding coral reefs? Three jurisdictions within NCRMP are so remote that they have no human inhabitants: the Pacific Remote Island Areas, the Northwestern Hawaiian Islands, and the Flower Garden Banks.

Benthic, fish, and climate data are collected every two years in the Atlantic areas and every three years in the Pacific areas due to extreme remoteness of some islands. Data are collected through SCUBA diving surveys of shallow-water reefs (0-30 meters). For climate data collection, methods include moored oceanographic instruments stationed at fixed points in the Atlantic and Pacific Oceans, water samples collected by divers, and satellite-based observations. These extensive monitoring data provide a comprehensive view of climate change impacts on coral reef ecosystems and help identify areas of resilience and vulnerability. The data are also used in modeling efforts to predict what may happen to reefs in the future. Scientists and coastal managers then use all four themes of data together to evaluate coral reef and fish population management strategies. In each jurisdiction each year, hundreds of sites are visited to sample all of the indicators in each theme.

REEFS CLOSEST TO HUMANS ARE DEGRADED

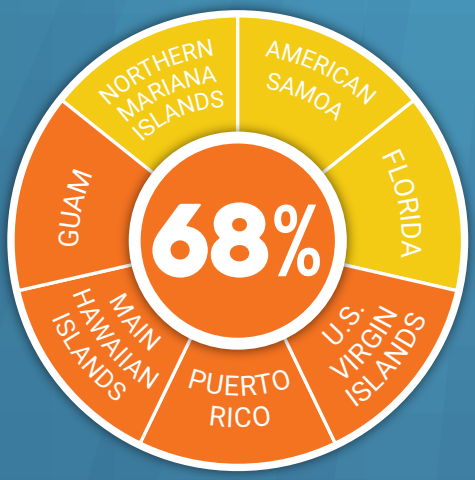
POPULATED REEF

REMOTE REEF

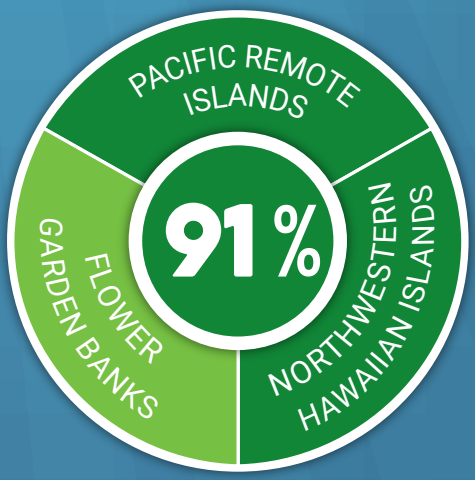
Coral reefs closest to human populations are degraded. The corals are not thriving, fish populations are impaired, and connections to reefs by local communities are lacking. Conversely, coral reefs that are farthest from human populations have fewer threats to combat. While coral bleaching from temperature stress, illegal fishing, and marine debris still impact remote reefs, these reefs tend to be more resilient to pressures due to minimal direct human contact. The good news is that U.S. residents generally support the use of Marine Protected Areas in both remote and more easily accessible regions, which indicates that coral conservation is seen as a net benefit for the public.

FISH ON REMOTE REEFS ARE LESS IMPACTED

POPULATED REEF FISH SCORE



REMOTE REEF FISH SCORE



Human activities have direct and indirect effects on coral reef fish populations and communities through fishing activities and habitat and environmental degradation. NCRMP fish data, when grouped by relative proximity to dense human populations, clearly show greater impacts to fishes in populated jurisdictions. Fish scores across all U.S. coral reefs range from impaired to very good, but good and very good scores only occur at remote reef areas. Impaired and fair scores only occur at populated reef areas. The overall combined fish scores in remote areas (91%) and populated areas (68%) are averages of the represented jurisdictions' fish scores. This clear divide in scores reflects the greater abundance of fish in remote reef areas, highlighting the effectiveness of management strategies like Marine Protected Areas and reduced fishing to better maintain and enhance fish populations on coral reefs.

CORAL REEFS ARE IMPORTANT, AND THEY ARE UNDER THREAT

Reef-building corals provide the foundational architecture for coral reefs. These colorful reefs provide vital habitat for a variety of commercially and ecologically important marine fishes and invertebrates. The abundance of reef marine resources as well as their beauty sustain local economies by supporting industries such as ecotourism and both recreational and commercial fishing. Reef capacity to absorb intense wave energy, especially during severe storms, also make coral reefs critical to disaster preparedness. Despite their importance, coral reefs are subject to local degradation via pollution and overfishing, as well as global degradation due to warming water and ocean acidification. Human production of excess greenhouse gases makes coral reefs vulnerable to continued degradation.

Want to learn more? Head over to NOAA's Coral Reef Information System for each U.S. jurisdiction's status report. Read about the coral reefs that make up the nine areas and what actions we can all take to protect and restore coral reefs.

(1) Healthy coral reefs provide ideal nurseries for important fisheries, Palmyra Island, Chasing Corals. (2) SCUBA divers explore Florida's coral reefs, Dry Tortugas, FL, Shaun Wolfe. (3) U.S. Virgin Island corals break oncoming waves before they hit the shore, which protect communities during storm surges, Christine Munisteri. (4) Tourism in places such as Saipan, CNMI is heavily dependent on coastal coral reefs as a major attraction, Flickr. (5) A regional fisher in the Northern Mariana Islands casts a net into the shallows, Alex Fries. (6) Fish for sale at a market in the Northern Mariana Islands, Mike Trianni. (7) A coral in the U.S. Virgin Islands suffers from the SCTLD epidemic, Leslie Henderson. (8) Runoff carries sediment and pollutants to coral reefs off the coast of Hawai'i, Bill Rathfon. (9) Corals on Jarvis Island after a severe coral bleaching event, NOAA.

Status report working group

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About this status report

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Acknowledgements

The CRCP supports effective management and sound science to preserve, sustain, and restore valuable coral reef ecosystems for future generations. For more information, visit coralreef.noaa.gov. Cover photo: The Ocean Agency/ XL Catlin Seaview Survey. Coral bleaching infographic inside: adapted from materials provided by The Ocean Agency.

The status report working group during the workshop in Silver Spring, MD, February 2020.

NOAA CORAL REEF CONSERVATION PROGRAM

University of Maryland CENTER FOR ENVIRONMENTAL SCIENCE INTEGRATION AND APPLICATION NETWORK