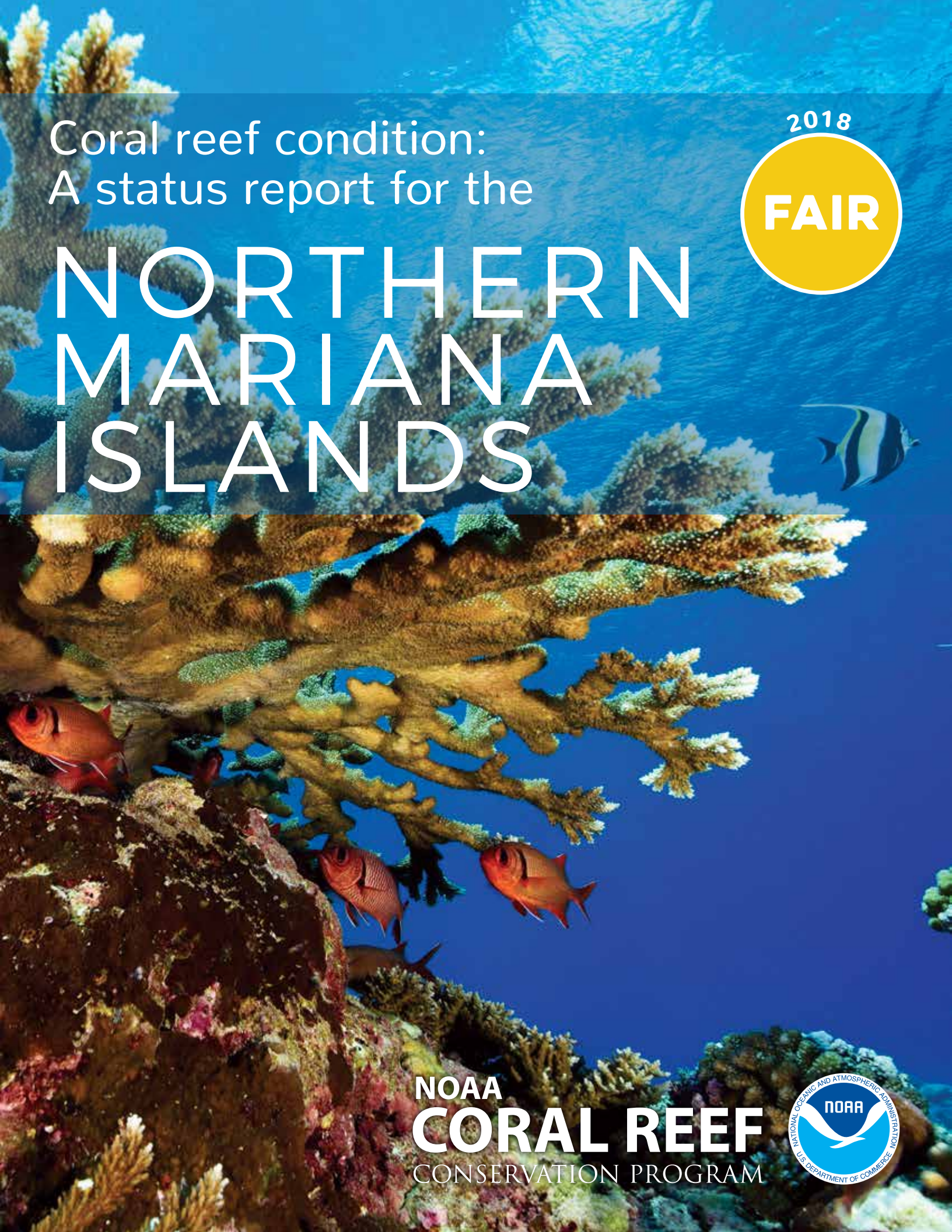


Coral reef condition:
A status report for the

NORTHERN MARIANA ISLANDS

2018

FAIR

NOAA
CORAL REEF
CONSERVATION PROGRAM

CORAL REEFS ARE IMPORTANT

Healthy coral reefs are among the most biologically diverse ecosystems on Earth, with high cultural and economic significance. Located in the western Pacific basin, the Commonwealth of the Northern Mariana Islands (CNMI) is made up of 14 islands extending over 600 kilometers. Coral reefs are important to the people of CNMI because they provide **traditional and subsistence uses, production of commercial food products, recreational opportunities for a healthy tourist economy, and physical protection from storms**.

Culture and Food

The indigenous ethnic groups of the Marianas, the Chamorro and Carolinian, are closely tied to the natural environment. Surveys indicate that about 96% of residents who go fishing, do so to feed their families. Ancient Chamorros and Carolinians were expert fishermen with inherent knowledge of harvesting reef fish species such as tàtaga (unicornfish), mafute' (emperor), and palakse' (parrotfish). Traditional fishing methods such as spearfishing and talaya (throw-net) help preserve the cultural identity of the islands. The connection between coral reefs and society is integral as the reefs provide habitat for most species as well as numerous ecosystem services, including protection of culturally significant areas along the CNMI coastlines. Surveys of CNMI residents indicate that 91% of respondents agree that coral reefs are important to their culture (NOAA National Centers for Coastal Ocean Science 2018).

Mike Trianni

Alexandra Fries

Tourism

The economic importance of the CNMI coral reef ecosystem is significant. In addition to providing food, shelter, and cultural significance for the citizens of CNMI, the coral reefs generate revenue from tourists and recreational users that are attracted to the beauty of the coral and its inhabitants. Tourists visit CNMI to swim, snorkel, dive, and experience both the beautiful coral reefs and the organisms that call them home. Tourism and development sustain the economy of CNMI. Striking a balance between facilitating economic growth and managing coastal resources in a sustainable manner continues to prove itself a challenge. However, multi-agency partnerships are invaluable towards the implementation of management actions that support economic growth while considering coastal conservation. Conservation and protection of the reefs will allow tourists and locals alike to enjoy the benefits they provide.

NOAA

Knexon Cho

1500 BCE
The first humans arrive in the Marianas.

1000 CE
The oldest Latte stones have been dated to approximately 1000 CE. The "Latte Period" lasts until 1521.

1521 The first known contact with Western Europe occurs by the Spanish.

1898
After the Spanish American War, Spain sells the Mariana Islands to Germany.

1905
Arrival of the Caroline Islanders who primarily settle in Saipan and Tinian.

1912 The Japanese invade and take over the Marianas from the Germans. After WWI, the League of Nations award the Marianas to Japan as mandated territory.

1930s
A thriving fishing industry develops on Saipan, as well as a sugar industry.

1944 Americans invade Saipan and capture the Marianas.

1944
The U.S. Army destroys coral to use as building material for airfield runway construction.

1947
CNMI recognized as a United Nations Trust Treaty administered by the United States.

REEFS ARE UNDER THREAT

Coral reefs in the CNMI are threatened by unsustainable fishing practices, climate change, land-based sources of pollution, overuse, and lack of enforcement.

Unsustainable fishing

Unsustainable fishing occurs when too many fish or all of one specific type of fish are taken. This causes fish species to decline on the coral reefs and impacts reef health. It also means that there aren't as many fish available as food, and some species may disappear altogether. Sustainable fishing practices allow fish populations to be maintained and support the coral reef ecosystem. Marine protected areas also help support fish populations.

Climate Change

Globally, climate change stressors, like ocean warming and acidification, are the leading threats to coral reefs. In the CNMI, reefs have undergone mass coral bleaching events during four of the last five years, resulting in reduced coral cover and changes in community composition. It is imperative to reduce local stressors that negatively affect the reef's ability to withstand climatic changes as well as to protect resilient coral populations.

Land based sources of pollution

Nonpoint source pollution is a leading cause of coral reef degradation in the southern CNMI. Water quality is particularly impacted by urban runoff, failing sewage systems, unpaved roads, farms, land clearing, and development. Stormwater that drains to the sea carries sediment and excess nutrients, which smother coral and cause algal blooms, severely compromising reef health and resilience.

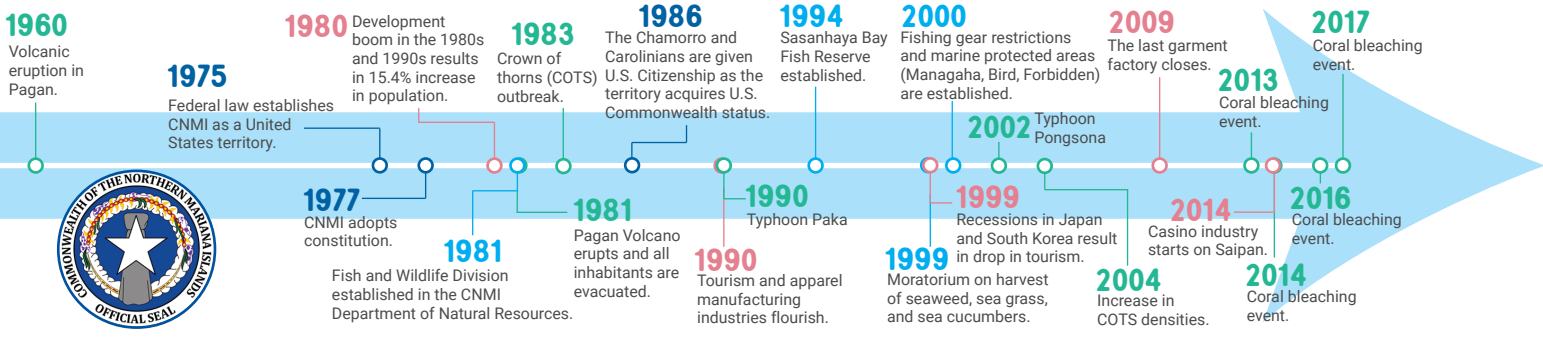
Overuse and lack of enforcement

Historically, coral reefs surrounding CNMI have been impacted by human uses. Military defense activities during World War I and World War II impacted reef habitat. Additionally, the anchoring of large commercial and naval vessels on shallow reef platform impacts reef habitat. Tourism is an important economic driver in CNMI, and managing human impacts on coral reefs continues to be a challenge.

WHAT YOU CAN DO TO HELP

There are many threats to coral reefs. Here are a few actions YOU can take to help conserve coral reefs:

- **Be responsible for the fishing gear that you use.**
- **Only catch enough fish for you and your family and be aware of fisheries regulations.**
- **Do not take fish from marine protected areas.**
- **Reduce energy use and your carbon footprint.**
- **Pick up your own trash and carry away the trash that others have left behind.**
- **Support initiatives to preserve and protect coral reefs.**
- **Plant native vegetation to prevent sediment and pollutants from reaching the reef.**
- **Don't dump household chemicals into streams, gutters, or drains.**
- **Help protect mangroves and wetlands from filling and construction activities.**
- **Don't stand on or touch live coral. Don't take pieces of corals home.**
- **Educate yourself about reefs and the creatures they support.**
- **Do not drop your anchor in reef areas, rather use sandy bottom areas.**



CORAL REEFS IN CNMI SUPPORT ECONOMY

CNMI's coral reefs support the economy by providing food from subsistence fishing, income from commercial fishing, and tourism from recreational activities such as snorkeling and diving.

Coral reefs are a food source on Saipan worth between $208,000 and $1.4 million per year, based on subsistence fishing by household (van Beukering et al. 2006). Hospital and Beavers (2014) surveyed small boat fishermen on Saipan, Tinian, and Rota, and found that they primarily fished on reefs, with 93% of these fishermen acknowledging reef fish were an important source of food.

While subsistence fishing is vital to CNMI's economy, commercial fishing also provides economic benefits. In 2014, the commercial fishery for coral reef fish species was valued over $150,000 (Western Pacific Fisheries Information Network). The contribution of fishing to CNMI's gross domestic product was $2.12 million in 2014 (Gillet 2016).

Tourists diving in The Grotto on Saipan. Marine-based tourism in CNMI contributes millions of dollars to the economy. Photo: Peter Edwards.

Tourism is an even larger part of CNMI's economy, and the number of tourist arrivals has been increasing since 2011 (World Bank). Marine-related tourism produces over $40 million per year, and, on average, 30% of tourists come to Saipan because of marine attractions. More than 350,000 diving or snorkeling trips take place in Saipan annually. These trips generate a direct economic value of over $4.9 million a year (van Beukering et al. 2006).

With all of these economic contributions based on the coral reef resources in CNMI, it is more important than ever to protect and manage the reefs. Sustainable management of the coral reefs will not only protect the ecosystems, but also support human use of these resources and protect their economic benefits.

FISHERIES SUCCESS IN SAIPAN LAGOON

The Saipan Lagoon is a critical part of the marine ecosystem of the island, as it has been a source of fish and other marine resources since the island's first inhabitants migrated to the Marianas over 4000 years ago. As population and development increased, the demand on marine resources did so as well.

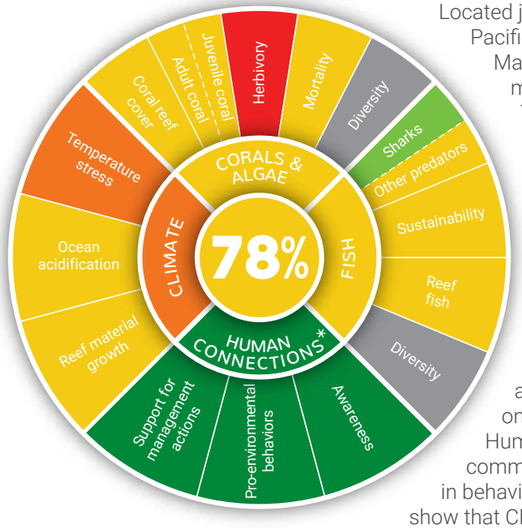
Part of Saipan Lagoon. Photo: CNMI Division of Coastal Resource Management.

Fish market surveys conducted during the 1990's by the CNMI's Division of Fish and Wildlife (DFW) found that CNMI fisheries could benefit from gear-based management (Graham 1994, Trianni 1998). In an attempt to protect habitat, reduce fishing power, and protect fisheries resources by reducing indiscriminate fishing, a net restriction was enacted in 2003. This restricted the use of gill and surround nets except under special permits granted for cultural fiestas. The net restriction was monitored by collecting data from fish extracted from the fiestas and from fisheries-independent underwater visual census of the Saipan Lagoon in 2004, 2007, and 2011. The surveys showed positive changes in certain food fish abundance and biomass within the lagoon (Trianni et al. 2018). This regulation is an example of managing fisheries effectively while being sensitive to cultural use.

*The Lagoon is home to a variety of fishes including these damselfish (*Chromis viridis*). Photo: John Iguel.*

NORTHERN MARIANA ISLANDS **CORAL REEFS**

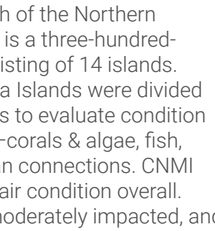
NORTHERN MARIANA ISLANDS

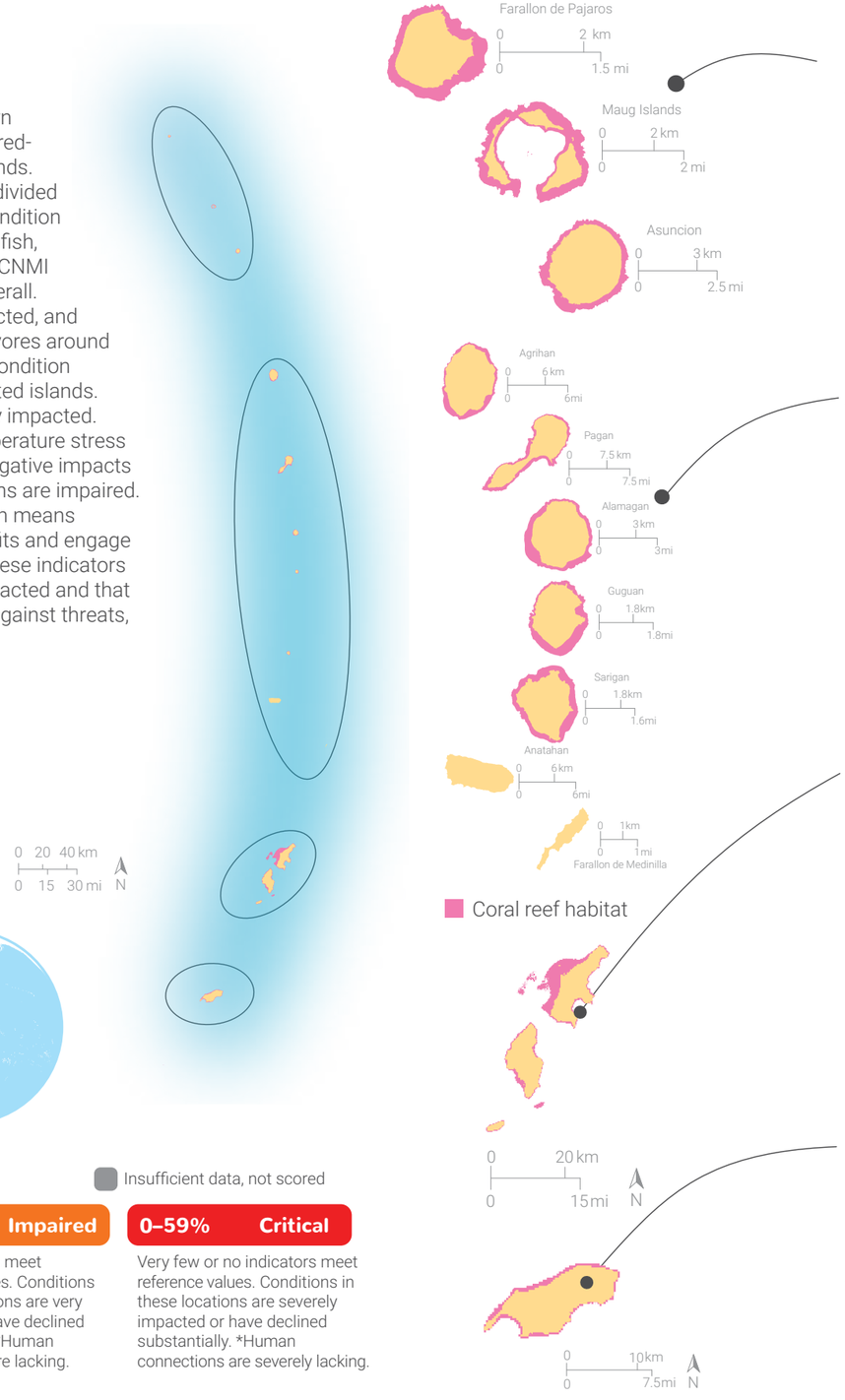


Located just north of Guam in the Western Pacific, the Commonwealth of the Northern Mariana Islands (CNMI) is a three-hundred-mile archipelago consisting of 14 islands. The Northern Mariana Islands were divided into four sub-regions to evaluate condition of four categories—corals & algae, fish, climate, and human connections. CNMI coral reefs are in fair condition overall. Benthic cover is moderately impacted, and herbivory levels are critical. Herbivores around unpopulated islands are in good condition compared to those around populated islands. Most fish indicators are moderately impacted. Overall fish conditions are fair. Temperature stress and ocean acidification are having negative impacts on coral reefs. Overall climate conditions are impaired. Human connections are very good, which means communities are aware of coral reef benefits and engage in behaviors that protect reef ecosystems. These indicators show that CNMI's coral reefs are moderately impacted and that overall conditions are fair. The Territory is struggling against threats, such as pollution, overfishing, and climate change.

While these scores reflect data collected through summer 2017, very recent data suggest coral reef bleaching has resulted in severe impacts. Up to 90% loss for some branching coral species has occurred around Saipan and Tinian. It is unclear what the impact of the latest bleaching event will be on all reefs of the Mariana Islands, but preliminary information suggests widespread loss across the archipelago.

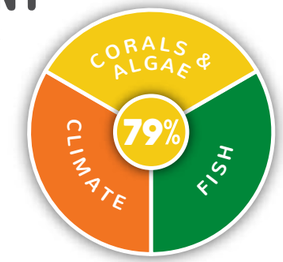
Biodiversity is a measure of the variety of living organisms. High biodiversity of corals, fish, and other organisms helps keep the ecosystem in balance and makes it resilient to environmental impacts. Although we measure biodiversity, the science is not yet mature enough to score biodiversity in an area. As the science and analysis progress, we will look to include biodiversity scores in future status reports.





NATIONAL MONUMENT

The Marianas Trench Marine National Monument protects approximately 95,714 square miles of submerged lands and waters of the Mariana Archipelago. The National Monument includes Farallon de Pajaros, Maug, and Asuncion. Coral reefs in the National Monument are in fair condition. This region had the lowest score for climate, an impaired score. Fish indicators were unimpacted, leading to very good conditions.



NORTHERN ISLANDS

The northern, uninhabited islands from north to south are Agrihan, Pagan, Alamagan, Guguan, Sarigan, Anatahan, and Farallon de Medinilla. Coral reefs in the Northern Islands are in good condition. This was the highest score of all four regions. This region had the highest score for fish, very good, and for corals & algae, fair. Climate conditions were impaired.

SAIPAN, TINIAN, & AGUIJAN

Saipan has the most diverse types of coral reefs and associated habitats in the CNMI. A fringing and barrier reef system protects the majority of the beaches along the western and coastal plains. Saipan has the largest population in the Mariana Islands, 48,220 people. Tinian has a population of 3,136 people. Coral reefs in this region are in impaired condition. This region had the same score as Rota. As is common in populated areas, reef fish populations are depleted, as indicated by relatively small sizes of fishery species and low overall fish biomass.

ROTA

Rota is the southernmost island of the Northern Mariana Islands. It has a land area of 85.5 square kilometers, with fringing reefs surrounding the island. The population is 2,527 people. Coral reefs on Rota are impaired due to fishing pressure, pollution, and climate change. This region had the lowest score for corals & algae, an impaired score. As is common in populated areas, reef fish populations are depleted, as indicated by relatively small sizes of fishery species and low overall fish biomass.

What do the scores mean?

Insufficient data, not scored

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.

*Human connections data are only collected at the overall Northern Mariana Islands level, not the sub-region level.

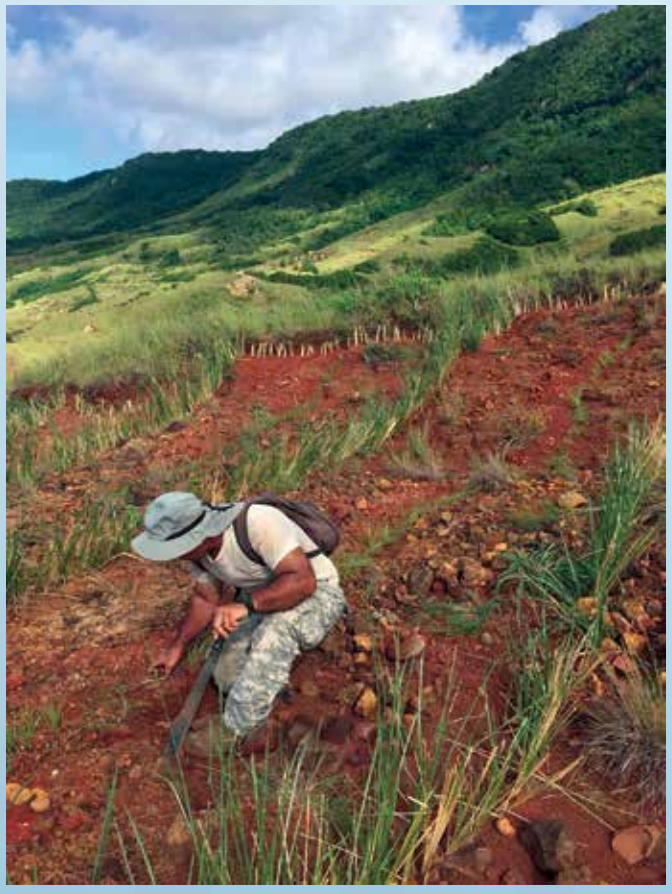
CONSERVATION ACTION PLANS SHOW SUCCESS

The CNMI has three Conservation Action Plans (CAPs) for adaptive 'ridge to reef' management of priority watersheds. They cover the Garapan, Lao Lao, and Talakhaya watersheds.

The Garapan CAP focuses on urban stormwater management, addressing polluted runoff from Saipan's dense center of commerce and tourism.

The Lao Lao CAP helps protect the coral of Lao Lao Bay—a prized cultural, recreational, and tourism resource—from upland erosion and sedimentation.

The Talakhaya CAP highlights reforestation of highly erodible soils in a remote watershed on the island of Rota. Illegal fires, set by hunters to expose deer, have created large barren areas that cause erosion. Over the past ten years, volunteers have re-planted rocky badlands with almost 400,000 vetiver plants, a grass renowned for its ability to naturally prevent erosion. As a result, less harmful sediment washes onto the reef below. The rows of grass also help retain nutrient-rich soil for the establishment of native forest.



Volunteers re-plant grasses to limit erosion as part of the Talakhaya Conservation Action Plan. Photo: Katie Graziano.

KEY THEMES & INDICATORS

CORALS & ALGAE

Corals & algae make up the base of the coral reef ecosystem, providing food and shelter for fish, shellfish, and marine mammals. The five indicators for corals & algae are:

- **Coral reef cover**, which includes corals, algae, and crustose coralline algae.
- **Coral populations**, a measure of the population's ability to reproduce and sustain itself.
- **Herbivory**, a measure of the level of grazing pressure by fish on corals and algae.
- **Mortality**, which measures the amount of recently dead coral.
- **Diversity**, a measure of the number of different species of coral present.

FISH

Coral reefs serve as habitat and food for fish species. Fish are important to the ecology of the reef, the economy, and the livelihoods of local communities. The four indicators chosen for fish are:

- **Reef fish**, a measure of the amount of fish present.
- **Sustainability**, which is indicative of whether fishery stocks still have abundant large breeding-sized fishes.
- **Sharks and other predators**, a measure of the amount of fish that eat other fish.
- **Diversity**, a measure of the number of different species of fish present.

CLIMATE

Climate affects all components of a reef system. Climate change and ocean acidification influence reefs across the globe, but conditions vary at the regional and local level. The three climate indicators are:

- **Temperature stress**, which evaluates the frequency and severity of high temperature events.
- **Ocean acidification**, indicating if the water chemistry is suitable for the growth of corals and other calcifiers.
- **Reef material growth**, which directly measures the increase in reef skeletal material in a particular place.

HUMAN CONNECTIONS

Coral reef management agencies protect reef resources through management plans, public education, and involving communities in managing their resources. The three indicators for human connections are:

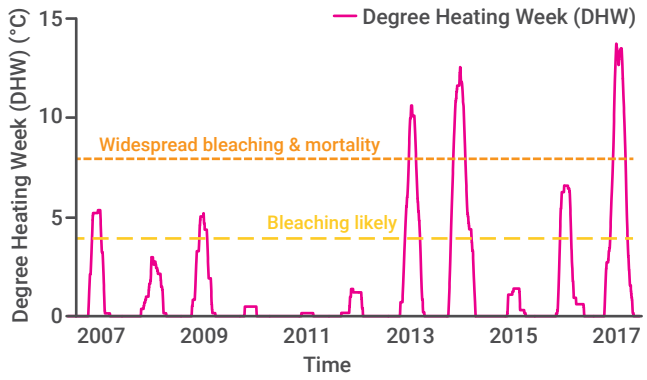
- **Awareness**, an indicator of residents' familiarity with threats to and the importance of reefs.
- **Support for management actions**, an indicator of support for reef management activities.
- **Pro-environmental behavior**, an indicator of residents' participation in activities to protect the environment.

CORAL REEF BLEACHING AND RESILIENCE

Coral bleaching occurs when water temperatures are warmer than usual for a sustained amount of time. This accumulated thermal stress can be measured in Degree Heating Weeks (°C weeks). At 4°C weeks, bleaching is likely to occur, and, at 8°C weeks, widespread bleaching and mortality is expected. From 2013-2017, the coral reefs of the CNMI experienced multiple thermal stress events that greatly surpassed the 8°C week benchmark, resulting in unprecedented coral bleaching and mortality across the archipelago. Over this four-year period, most coral species were affected across all islands and reef zones, down to at least 20 meters depth.

While global scale reductions in carbon emissions are necessary to mitigate ocean warming, it is also important that the CNMI continues to work to improve the resilience of coral reef communities by reducing local-scale stressors, such as land-based pollution and overfishing.

CLIMATE STRESS ON CORALS



Severe bleaching events were observed in 2013, 2014, 2016, and 2017. Data from NOAA Coral Reef Watch Program.

Coral bleaching on the Saipan Forereef in 2017 was the most severe event on record. Photo: Lyza Johntson.

WHY A STATUS REPORT?

Effective coral reef conservation cannot be accomplished without an informed and engaged public. This status report is part of an ongoing series of documents to track the status and trends of coral reefs across the U.S. and its territories. **The Northern Mariana Islands coral status report is part of a larger effort to provide the public and decision-makers with information about managing and conserving coral reef ecosystems.**

This status report provides a geographically specific assessment of the Northern Mariana Islands coral reef condition for the period 2012–2017. The Islands were divided into four sub-regions based on data resolution, geographical features, and impacts to the ecosystem. Data were collected by NOAA's National Coral Reef Monitoring Program. For more detailed information on methodologies, indicators, thresholds, and grading, visit http://www.coris.noaa.gov (keyword: status reports).

About this status report

This status report is a joint product of NOAA's Coral Reef Conservation Program (CRCP) and the University of Maryland Center for Environmental Science. Science communication, design, and layout by Alexandra Fries, Caroline Donovan, & Heath Kelsey. November 2018.

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Cover photo of Acropora at Wing Beach by Richard Shaul. Timeline photos: Headquarters of the government of the South Pacific Mandate in Saipan via Wikimedia Commons; WWII Memorial by Alexandra Fries; and Seal of Northern Mariana Islands via Wikimedia Commons.

For more information, visit coralreef.noaa.gov

Acknowledgements

The CRCP supports effective management and sound science to preserve, sustain, and restore valuable coral reef ecosystems for future generations.

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The status report working group during the workshop in Saipan, February 2017.

NOAA CORAL REEF

University of Maryland Center for Environmental Science