Coral reef condition:
A status report for
GUAM
2018
FAIR
Coral reefs are important

Healthy coral reefs are among the most biologically diverse ecosystems on Earth, with high cultural and economic significance. They provide billions of dollars in food, jobs, recreational opportunities, coastal protection, and other important goods and services to people around the world. Guam’s coral reefs are an integral part of the culture, livelihoods, and aesthetics of the island.

Food
Fishing provides Guam residents with an accessible and healthy source of protein. Nearshore coral reef habitats are important to both subsistence and commercial fishing. Survey data indicate that 30% of residents fish or gather marine resources and 94% of residents who do fish, do so to feed themselves or their family (NOAA National Centers for Coastal Ocean Science 2018). Traditionally, a large catch was shared by many people, providing a much needed food resource. Traditional marine management was conducted at the village level. Under modern management at the island-scale, enforcement of marine preserve regulations is an ongoing challenge on Guam.

Biodiversity
Coral reef ecosystems are renowned for the stunning diversity of life they support. Although they occupy less than 1% of the seafloor globally, it is estimated that more than 25% of all marine species can be found on coral reefs (Burke et al. 2011). On Guam, there are over 5,000 species of coral reef organisms (Paulay 2003). Protecting this impressive biodiversity through management and conservation is important for sustaining healthy reefs and the human communities dependent on them.

Tourism
Coral reef-related tourism contributes $323 million per year to Guam’s economy (Spalding et al. 2016). The tourism industry supports over 21,000 jobs annually, representing 34% of total employment (Guam Visitors Bureau 2018). Each year, Guam’s reefs host over 300,000 tourist snorkelers and 100,000 tourist scuba divers (QMark Research 2016a, 2016b). In addition, over 30% of visitors cite the marine environment as a top reason for visiting Guam (Guam Visitors Bureau 2018).

Shoreline Protection
The coral reefs found in the nearshore areas and lagoons of Guam provide many benefits to the island’s shorelines. Coral reefs form a natural breakwater, protecting the shoreline by absorbing and reducing wave energy by 97% on average (Ferrario et al. 2014). This prevents erosion and beach loss, which can lead to economic hardship. Shoreline protection is important for Guam, which is subjected to typhoons that may increase in severity due to climate change.
Guam, likely from southeast Asia. 2000 BCE

The first inhabitants, ancestors of the people of Guam, likely from southeast Asia. The oldest Latte stones have been dated to approximately 800 CE. Between Guam and Western Micronesia, the first known contact was during the Spanish expedition led by Ferdinand Magellan in 1521, giving the U.S. its first possession in the Pacific. The United States captures Guam during the Spanish-American War, which ends on July 21, 1898.

The second Battle of Guam began on July 21, 1944 when American fighting against Japanese forces officially begins. After several weeks of widespread destruction, Japanese forces officially surrender on August 10, 1944.

The Guam Organic Act makes Guam a territory with limited autonomy, and in 1946, Guam and the Marshall Islands, and Palau, spurring the U.S. to formalize the Compacts of Free Association with the Federated States of Micronesia, Republic of the Marshall Islands, and Palau, in 1986. From 1980–1990, decreases in the population from 50% around Guam decreases to about 25%. From 1990–1990, average coral cover around Guam decreases from 50% to about 23%

Guam loses 9 of 11 native bird species. The brown tree snake reaches Guam and begins feeding on Guam’s birds, resulting in a 15.4% increase in population. In 1978, Guam joins the Micronesia Challenge.

Fish declines impact fishermen’s profits, ecosystem services, with over 90% of the live coral lost and many species impacted. Climate change and overfishing contributes to global declines in reef fish. In 1974, the Guam Seashore Protection Act is passed. Coral reefs are declining globally, which has significant ecological, social, cultural, and economic impacts on people and communities. Guam’s coral reefs are threatened by overfishing, climate change, pollution, and overuse.
**MARINE PRESERVES HELP FISHERIES**

Guam has established five marine preserves to protect, preserve, manage, and conserve aquatic life, habitats, and marine communities and ecosystems. The five preserves are Piti Bomb Holes, Achang Reef Flat, Pati Point, Sasa Bay, and Tumon Bay.

Guam's network of marine preserves was created in 1997 to restore declining fish stocks. The preserves have been enforced since 2001. Although protection of these areas is difficult due to insufficient enforcement of regulations, there are signs of improvement. Studies have confirmed that limiting fishing in these areas has had a positive effect on species density and diversity (The Territory of Guam and NOAA Coral Reef Conservation Program 2010). The increased number, size, and diversity of fish within the protected areas has allowed residents and visitors to recognize the value of Guam's marine preserves.

![Image: The size of reef fish has increased in and around the Piti Bomb Holes Marine Preserve. Photo: Dave Burdick.](image_url)

**COMMUNITY-BASED MONITORING ON GUAM**

Community involvement in marine resource management enables critical conversations about and actions around coral reef protection. The Guam Community Coral Reef Monitoring Program was launched in 2012 to create more opportunities for Guam residents to engage in coral reef management through experiential learning about Guam’s coral reefs and first-hand observation of the challenges facing them.

![Image: Members monitoring in Piti. Photo: NOAA.](image_url)

Local community members are trained to survey the condition of corals, algae, and macroinvertebrates, all of which are important indicators of habitat health. Trained program members complete monitoring surveys on reef flats around Guam. Community-collected data is shared at member meetings and with local reef managers for informed updates on Guam’s reef flat health at monitoring sites. The Guam Community Coral Reef Monitoring Program encourages community members to be stewards of Guam’s natural resources so that their cultural, social, and economic value can be preserved for the people of Guam.

![Image: A group of volunteers preparing to go monitor the reef. Photo: NOAA.](image_url)
Guam is an unincorporated territory of the United States in the western Pacific Ocean. It is the largest and southernmost island of the Mariana Archipelago. The island, which is 210 square miles, is surrounded by fringing coral reefs. Approximately 162,000 people live on Guam, with 1.5 million tourists visiting annually. Guam was divided into three sub-regions, western (leeward), eastern (windward), and marine preserves, to evaluate condition of four categories—corals & algae, fish, climate, and human connections. Guam coral reefs are in fair condition overall. Benthic cover is very impacted, and herbivory levels are critical. Fish are very impacted and overall fish indicators are impacted. 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. Climate is also a factor negatively affecting coral reefs. Overall climate conditions are fair. Temperature stress is having an impact on coral reefs. Human connections are good, which means communities support management actions and engage in behaviors that protect reef ecosystems. These conditions show that Guam’s coral reefs are moderately impacted, and overall conditions are fair. Guam’s reefs are struggling against threats such as pollution, overfishing, and climate change.

**What do the scores mean?**

- **90–100% Very good**: 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 moderately impacted or have declined moderately. Human connections are high.
- **70–79% Fair**: Some indicators meet reference values. Conditions in these locations are moderately impacted or have declined considerably. Human connections are moderate.
- **60–69% Impaired**: Very few to no indicators meet reference values. Conditions in these locations are severely impacted or have declined substantially. Human connections are severely lacking.
- **0–59% Critical**: Insufficient data, not scored.

**Insufficient data, not scored**

While these scores reflect data collected through summer 2017, very recent data suggest coral reef bleaching has resulted in severe impacts. 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.
**REEF RESTORATION**

On Guam, reef restoration is recognized as an important approach to restoring the health of degraded reefs. Natural resource managers are extremely interested in reef restoration as a tool to recover degraded reefs. In 2018, stakeholders formed the new Guam Reef Restoration and Intervention Partnership (GRRIP), to develop an island-wide strategy for restoration.

An ocean-based coral nursery was installed in the Piti Bomb Holes Marine Preserve during workshops in 2013 and 2014. The University of Guam and Underwater World Guam co-organized the workshops, in which field training taught participants how to use sexual coral reproduction for restoration efforts. In 2015, a mass spawning occurred and more than 1000 larvae settled on tiles in the floating nursery. Spawning work continued in 2016 with support from the Aquarium of the Pacific. The nursery also contains over 1,000 fragments of five species of staghorn Acropora corals, which are a vital component of Guam's coral reef communities. Local scientists and resource managers have already experimentally outplanted some of these corals and plan to scale-up efforts to restore degraded reefs. Local stakeholders plan to install a second nursery in 2019.

In addition to the coral nursery and sexual propagation, Guam is experimenting with micro-fragmentation and various outplant methods to increase restoration success. Restoration of other coastal systems, such as seagrasses and mangroves, is also being considered.

**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.
Local natural resources managers are striving to protect and restore Guam’s coral reefs through an integrated, collaborative ridge-to-reef approach. Managers are taking actions to identify challenges identified by stakeholders.

<table>
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<tr>
<th>Challenge Action</th>
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<tr>
<td>Lack of awareness of coral reef health and impacts among community members</td>
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<td>Lack of local legislation to protect coral reef resources</td>
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<tr>
<td>Insufficient enforcement of Guam’s marine preserve regulations</td>
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<td>Conflict between coral reef user groups and natural resource managers</td>
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<td>Uncertainty surrounding future climate change impacts</td>
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**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 Guam 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 Guam coral reef condition for the period 2012–2017. Guam was divided into three 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](http://www.coris.noaa.gov) (keyword: status reports).

Status report working group

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About this status report

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Cover photo by David Burdick.

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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](http://coralreef.noaa.gov).

References


The status report working group during the workshop in Guam, January 2017.

Funding to build capacity for Guam’s conservation officers to enforce preserves.