



Status of Coral Reefs of the World: 2020

Conclusions

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Conclusions

The value of coral reefs

Coral reefs occur in more than 100 countries and territories and whilst they cover only 0.2% of the seafloor, they support at least 25% of marine species and underpin the safety, coastal protection, food and economic security of hundreds of millions of people. The value of goods and services provided by coral reefs is estimated at US\$2.7 trillion per year, including US\$36 billion in coral reef tourism. Maintaining the integrity and resilience of coral reef ecosystems is essential for the wellbeing of tropical coastal communities worldwide, and is a critical part of the solution for achieving the Sustainable Development Goals under the 2030 Agenda for Sustainable Development.

Coral reefs are among the most vulnerable ecosystems on the planet to anthropogenic pressures, particularly those influenced by climate change, such as mass coral bleaching events tropical storms and ocean acidification. In addition, the world's coral reefs face myriad other local threats such as land-based pollution particularly nutrients and sediments from agriculture, marine pollution, overfishing and destructive fishing practices, outbreaks of crown-of-thorns starfish and coral diseases that cause local-scale degradation of coral reefs.

A quantitative analysis of a global dataset

This sixth edition of the GCRMN Status of *Coral Reefs of the World* report is the first since 2008, and the first based on the quantitative analysis of a global dataset compiled from raw monitoring data contributed by more than 300 members of the network. The global dataset spanned 41 years from 1978 to 2019 and consisted of almost 2 million observations from more than 12,000 sites in 73 reef-bearing countries around the world.

The vast majority of these observations have been collected since 1998, which is when the first global-scale coral bleaching event occurred, affecting nearly all coral reef regions. This event triggered a substantial increase in global monitoring effort to measure the impacts on the world's coral reefs. Since then, many monitoring programs have been maintained and new programs have been established, often in response to more recent mass bleaching events. This has resulted in greater spatial and temporal resolution of monitoring data and increased knowledge of the status of coral reefs at national, regional and global scales.

However, despite the increase in the amount of coral reef monitoring data, there was considerable variation in the way in which data were collected, the level of taxonomic detail recorded, and the way in which data were described (metadata) for sharing and re-use. Although, the data were collated and homogenized into a standard format that enabled statistical analysis of common variables, only live hard coral cover and algal cover were measured in a sufficiently consistent manner by different monitoring programs around the world to support a quantitative global analysis.

While the covers of both live hard coral and algae are globally accepted and universally used indicators of coral reef health, the report was unable to describe changes in coral community composition, the status of coral reef-associated fish populations, or the human dimensions associated with coral reefs. This highlights that there is a clear need for greater interoperability of coral reef monitoring data. This can be achieved through the adoption of more comparable data collection methods to enhance the

resolution of information collected and to facilitate integration of data from different sources. Further, the adoption of data standards will promote appropriate storage, access, sharing and re-use of data.

In many regions of the world, enhancing the quality and interoperability of coral reef monitoring data will require considerable investment in building capability and capacity to monitor coral reefs. Such investment can be enhanced by combining it with the use of new and emerging technologies, which range from satellite mapping to automated analysis of coral reef images. In the future, a collaborative, integrated approach using traditional methods and new technologies for data collection and analysis will be critical to enable rigorous and timely reporting of the status of coral reefs at local, national and global scales. Availability, interoperability and reliability of data are crucial to inform coral reef management and investment in coral reef protection and restoration. The GCRMN has a role in supporting vital, ongoing investment in the development of methodological approaches, new technologies, capability and capacity to achieve this in the future.

Global status of coral reefs

Prior to the first major mass coral bleaching event in 1998, global average cover of hard coral was high (>30%) and stable. The global average cover of algae was also stable at about 15% until 2011. On average, there was twice as much coral on the world's reefs compared with algae.

The first global mass coral bleaching event in 1998 killed about 8% of the world's coral, which is roughly the equivalent of removing all the coral currently living on coral reefs in any of the Caribbean, Red Sea and Gulf of Aden, South Asia or Western Indian Ocean regions. The global average cover of algae did not change in response to the 1998 global coral bleaching event.

In the absence of large-scale disturbances, the global average cover of hard coral recovered to pre-1998 levels within a decade. However, between 2009 and 2018, there was a progressive loss amounting to 14% of the coral from the world's coral reefs, which is more than all the coral currently living on Australia's coral reefs. During this period, the amount of algae on the world's coral reefs increased by about 20%. As a consequence, the ratio between the global average covers of hard coral and algae has declined from 2.4 in 2010 (i.e. 2.4 times as much coral on the world's reefs as algae) to 1.7 in 2019. This global pattern of decreasing coral cover and increasing amounts of algae is a strong indication that the condition of the world's coral reefs is declining. A progressive transition from coral to algal dominance reduces the complex three-dimensional habitat that is essential to support high biodiversity and provide valuable goods and services for reef-dependent human communities.

The primary cause of the decline in global average coral cover was recurring large-scale coral bleaching events caused by elevated sea surface temperatures (SST). At a global level, strong positive global SST anomalies correspond with the major episodes of coral decline. All three global coral bleaching events (1997-98, 2010 and 2015-2017) have coincided with consecutive months of rapidly increasing SST anomalies, while sustained high SST anomalies after the 2010 event and from 2013 onwards may have hindered the recovery of corals and facilitated progressive increases in the cover of algae.

During the last decade, the interval between mass coral bleaching events has been insufficient to allow coral reefs to recover, highlighting their vulnerability to marine heatwaves, which is a phenomenon that is likely to happen more frequently as the planet continues to warm. The Intergovernmental Panel on Climate Change (IPCC) predicted that coral reefs would decline by 70-90% with global warming of 1.5°C and virtually lost with 2°C of warming. The most recent report by the IPCC showed that warming will continue at least until mid-century under all emission scenarios and predicts that 1.5°C and 2°C

will be exceeded this century unless deep reductions in greenhouse gas emissions occur in coming decades.

Local and regional-scale threats, such as coral diseases, crown-of-thorns starfish outbreaks, tropical storms, overfishing and destructive fishing and poor water quality resulting from land-based pollution continue to exert significant influence on coral reefs. Controlling these threats rightly remains the focus of local-scale management.

Implications for management and policy makers

This report showed a strong association between a decline in coral cover and progressively rising sea temperatures associated with climate change. It is clear that a reduction in global emissions is necessary to deliver a positive future for coral reef ecosystems and the human communities that depend on them. Global action through the Paris Agreement to hold the increase in the global average temperature to well below 2°C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels is crucial for the future of coral reefs.

However, the report also showed that despite increasingly frequent mass coral bleaching events, which has been insufficient to allow coral reefs to fully recover, periods of recovery have been observed during the last two decades, and most recently in 2019 with coral reefs regaining 2% of the coral cover that was previously lost. These increases in coral cover are important, as they indicate that many of the world's coral reefs remain resilient and can recover if conditions permit. It shows that all is not lost for the world's coral reefs, but that our window for securing their future is closing, and a concerted global effort is required to ensure the trajectory of coral reef health is positive, while at the same time, reducing local threats.



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