THEME	**Coastal and Marine**
INDICATOR	**Live Coral Cover**

DEFINITION	% of live coral cover in coastal and marine environments
PURPOSE	Indicator of overall health of reef ecosystems. These ecosystems provide important services for humans
DESIRED OUTCOME	Stable or positive trend in live coral cover

Status
Poor to fair

Trend
Deteriorating

Data confidence
Low

Tuvalu reef. © Peter McDonald

PRESENT STATUS

Simplifying coral reef ecosystems to a single number for a country, or for a region, runs counter to our knowledge of the complexity and variability that characterise healthy reefs in a healthy oceanscape.

The Pacific island region has very diverse corals and many types of reefs. Due to differences in the coral shapes and associated community of species, it is not possible to identify a single value as a health threshold for live coral cover. Instead, we can look for changes in live coral cover at a given reef, along with changes in species abundance and other factors that characterise a coral reef system.

That said, the regional average for coral cover was 26% in 2018 according to the *Status and Trends of Coral Reefs in the Pacific*, which only included data from 75 sites, a very low sampling density for a very large, diverse region with over 27,000 islands and an even greater number of reefs. There is a large amount of variability in coral cover among islands and habitats, in part due to the low sample number and representativeness of sites studied to date. Coral cover has been relatively stable over the past two decades in the Pacific Island Region, with a decrease of only 3% in the last 18 years.

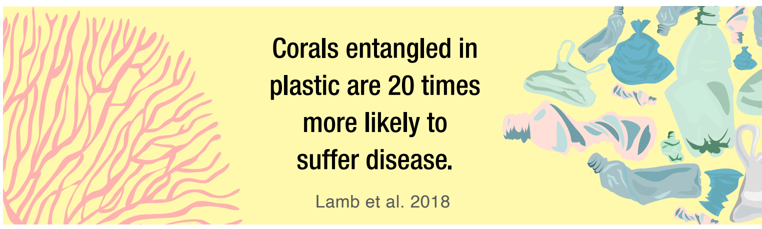
Studies suggest that the Pacific coral cover baseline (before recent change) could be higher than the 26% average reported in 2018 (Bruno 2013, Eddy et al. 2018). For healthy reef ecosystem services, a live coral cover closer to 30% or more might be needed; ongoing research is seeking to identify meaningful Pacific targets.[1] In the Western Indian Ocean, fish biomass drops off considerably and precipitously at sites with live coral cover below about 25% (McClanahan et al. 2011).

High variability in coral reef cover among the studied sites also supports the idea that reef health is driven by local factors, not just global changes. Local management actions can support local coral ecosystems and help to mitigate the inevitable effects of global change, at least in the near future.

Information from national sources, the *State of Conservation in Oceania* regional and national reports, and the growing body of research from Pacific reef scientists are essential to help managers identify reef health baselines and gaps in research and management. Regional and global reports by the Global Coral Reef Monitoring Network (GCRMN) help give global visibility to local reefs and compare only consistent datasets to produce regional-scale findings.

Declines in live coral cover have been an issue of concern in the Pacific islands region for many years. For example, Bruno & Selig (2007) showed approximately 20% mean coral cover for the southwestern Pacific and approximately 22% to 23% mean coral cover for the western Pacific, with a downward trajectory in live coral cover.

The status of the region's live coral cover was deemed fair, with the majority of Pacific islands still having relatively high live coral cover compared to an estimated historical baseline. Records across the region are patchy, leading to a low data confidence ranking. With significant threats, especially from climate change and natural disasters, the overall trend in the extent of live coral coverage is considered to be deteriorating.



[1] Wildlife Conservation Society (Fiji), Dr Stacy Jupiter and Dr Sangeeta Mangubhai, pers. comm.

Currency of corals

- Without reefs, annual flooding damages could double and frequent storm damages could triple in cost (Beck et al. 2018).
- Globally, coral reef value decreases by 3.8% when coral cover falls by 1% (Chen et al. 2015).
- As the ocean warms and coral reefs decline, a global loss of tourism and recreation value in the near future (2031–2050) of almost USD 3 billion per year (constant 2000 values) is projected under RCP 2.6 and up to USD 5.8 billion per year under RCP 8.5 (IPCC 2019).

CRITICAL CONNECTIONS

Pacific corals are important for the ocean and for the whole planet. Reefs provide a broad range of ecosystem services, across the full spectrum of supporting, provisioning, regulating, and cultural services. The difficulty in quantifying all reef ecosystem services in economic terms should not stop us from protecting those services and acknowledging their value. The impacts of reefs on our societies, identity, and wellbeing are valid, with socioeconomic flow-on effects.

Healthy reefs are valuable and save money that would otherwise be lost to storm and flood damages. Maintaining healthy coastal wetlands like coral reefs is the most cost-effective method of preventing shoreline erosion and avoids many costly problems associated with shoreline hardening, such as seawalls (Ferrario et al. 2014).

Reef conservation, restoration, and potential adaptation interventions are complex. However, in Indonesia, “there is high confidence that reefs with high species diversity are more resilient to stress, including bleaching” (Ferrigno et al. 2016). Boosting reef biodiversity benefits both reefs and local communities. Healthy, connected local ecosystems can support climate resilience.

Regime shifts in reef ecosystems can alter the species available for use. In some cases, shifts to more algal cover may be accompanied by more herbivorous fish. We must support our communities to take advantage of these changes in a sustainable way.

Coral reef health and island health rely on each other. Coastal development can cause direct physical impacts on coral reefs as well as changes in the movement of water and sediment in the nearshore ecosystem. Waste management and nutrient pollution also affect the balance of algae and coral on reefs. Lagoon water quality relies on management on land, from sustainable agricultural practices to the preservation of native forests, both upland and coastal.

PRESSURES AND OPPORTUNITIES

Corals form iconic Pacific wetlands (see Regional Indicator: Wetlands). Nearshore coral reefs are home to some of the most iconic and important Pacific wildlife that form the foundation of local food security, livelihoods, economies, and—through the production of sand and protection from waves—the island shorelines themselves.

Coral reefs are the marine ecosystem most threatened by climate-related ocean change, especially ocean warming and acidification (IPCC 2019). In the warming ocean, marine species are moving poleward by 30 to 50 kilometres per decade, but corals and island reef ecosystems are less mobile and more geographically constrained.

The projected future of coral reefs significantly differs between low-emission and high-emission future scenarios. Should global warming surpass 2°C, over 99% losses of coral reefs are expected (IPCC 2019). By 2050, almost all reefs in the Pacific are predicted to be rated as threatened, with more than half rated as at high, very high or critical. Cumulative impacts, including pressures from human use, reduce the capacity of reefs to keep pace with sea level rise (IPCC 2019).

However, the Pacific region contains several hope spots for reefs. For example, unlike other places that have seen repeated events, Fiji seems to have been spared repeated large-scale bleaching. The summer maximum sea surface temperatures in Fiji often align with the local cyclone season, during which storms can cool waters down (Mangubhai et al. 2019). Reefs in Fiji, New Caledonia, and Palau are under long-term study by local scientists and demonstrate strong resilience to climate change (e.g. Adjeroud et al. 2018, Mangubhai et al. 2019).

In the context of the strong dependence of reefs on local conditions and local management decisions, regional partnerships are also important to address the transboundary threats to coral reefs of ocean warming, ocean acidification, and pollution, including plastic debris (see Regional Indicator: Marine plastic pollution).

With Pacific population increases and the demand for altered land-use, potentially with more hard-scaping, most pressures on reefs are likely to rise. Human presence is connected to reef health: for example, low reef-builder cover (coral and coralline calcareous algae) was observed on reefs around inhabited islands (Smith et al. 2016). There are signs that marine protected areas can help maintain or restore live coral cover (e.g. Ziegler et al. 2018). In 2020, marine protected areas in the Pacific encompassed about 31% of the total coral reef area of the Pacific; see Regional Indicators: Wetlands and Protected Areas.

Acknowledging the multiple, emerging threats to corals, the post-2020 CBD framework draft action (target 1) includes language around integrity; measures of live coral cover could help identify sites with high integrity (once appropriate thresholds are defined). Ecological integrity is an important concept, particularly for ecosystems in which humans play a strong role. Because of their proximity to coasts, coral reefs are heavily impacted by human activities and are underrepresented in the approximately 13% of the ocean classified as marine wilderness (Jones et al. 2018).

Scientific knowledge of Pacific reefs is limited. Such knowledge would have national, regional, and global value, and growing the scientific capacity for Pacific reef research will require investment in local experts. Existing time series on many reefs are not sufficient to identify changes in reef health over time. Data for standard indicators such as coral recruitment and turf algal cover are limited. Globally, Fisher et al. (2015) estimated that 32% of all named marine species occur on coral reefs and that approximately 75% of the species that inhabit coral reefs are yet to be identified. Reefs may host more than 9 million species worldwide (Plaisance et al. 2011).

To date, we have limited evidence of the relative costs and benefits of proposed reef interventions, considering economic, ecological, social, and cultural dimensions. However, the threats to corals are outpacing our scientific knowledge, making comprehensive climate action essential to reduce warming even as we continue to learn ways to help corals survive.

Because reef services have been free, conservation actions are often assumed to be a cost burden. Instead, we can recognise their value. The innovative insurance policy on the Mesoamerican Reef[1], the first insurance policy on natural infrastructure, is an example of creating financial tools that support people and nature in the face of disaster.

REGIONAL RESPONSE RECOMMENDATIONS

Because reef health is closely linked with global climate, local water quality, and physical disturbance, the required actions for managing healthy coral reefs must extend from global to local levels. Diverse, healthy Pacific reefs require joint action within an integrated management structure to effectively address the findings of the scientific community and the expertise of Pacific people. Coherent management plans from land to sea will be essential for coral health.

Recommendations for linking biophysical and socio-cultural data for effective nearshore management have been created based on a survey including Pacific reef managers (Wongbusarakum et al. 2019). The International Coral Reef Initiative defined a set of recommended indicators at the global level (ICRI 2020), but capacity to measure and report against these indicators varies.

At the regional level, countries can commit to:

- Measure live coral cover over repeated time increments and across a range of reef habitats and geographies. Quantifying the change in coral lifeform and genera is also important because reef ecosystem services differ among types of corals;
- Mitigate pollution, including sediments, nutrients, and plastics; greenhouse gas emissions; and unsustainable harvest considering method, gear, and seasonal harvest rates;
- Plan to protect coral reefs for inclusive food security, shoreline protection, and social and cultural functions;
- Enforce protection, building partnerships with the fisheries and tourism sector as well as between land and marine managers; and
- Partner for restoration of coral reefs, ensuring development partners understand the natural spatial distribution of corals. Efforts spent introducing corals into other ecosystems with inappropriate conditions may be wasted as the corals will perform poorly and other native species may be displaced.

REEF COMMUNITIES ARE CHANGING

Porites appears to be a winner coral genus at the Pacific scale, surviving all disturbances and growing at the expense of other genera. A 20-year survey shows that *Porites* was a minor genus in terms of cover in the 1990s, but it represents nearly 50% of the average live coral cover in the Pacific islands region after 2010. Many *Porites* form relatively smooth masses, whereas others like *Porites rus*, *Porites cylindrica* and *Porites compressa* are very common inshore species that can form complex structures that support associated fish and invert communities.

Source: *Status and Trends of Coral Reefs in the Pacific*

[1] See https://meam.openchannels.org/news/meam/can-we-insure-our-way-healthier-oceans-and-ocean-communities

Aganoa Reef, Samoa. © Lagi Reupena

INDICATOR IN ACTION SDGs 14.2, 14.5 • Ramsar Convention • SAMOA Pathway (58e) • Pacific Regional Environment Objectives 2.1, 2.2 • Pacific Islands Framework for Nature Conservation Objective 4

FOR MORE INFORMATION

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SPREP PROE

The Secretariat of the Pacific Regional Environment Programme (SPREP) supports 14 countries and 7 territories in the Pacific to better manage the environment. SPREP member countries and members of the Pacific Roundtable on Nature Conservation (PIRT) have contributed valuable input to the production of this indicator. www.sprep.org

National and regional environment datasets supporting the analysis above can be accessed through the Pacific Environment Portal. pacific-data.sprep.org

For protected areas information, please see the Pacific Islands Protected Area Portal. pipap.sprep.org