THE GOOD NEWS ON CORAL REEFS

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The Global Warming Policy Foundation
Note 33

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About the author

Peter Ridd is a physicist. He has researched the Great Barrier Reef since 1984, and has published over 100 scientific publications. A former head of the Marine Geophysical Laboratory at James Cook University, Townsville, Australia, he was fired in 2018 for pointing out quality assurance deficiencies in reef-science institutions.

Introduction

Up to 2016/2017, the Australian Institute of Marine Science (AIMS) published aggregate data for coral cover on the Great Barrier Reef (GBR). Since then, only disaggregated data has been made available. This paper examines AIMS' explanation for this decision, and recreates the aggregate figure for recent years, showing that AIMS has effectively hidden the good news on coral cover.

What is coral cover?

Coral cover is a measure of abundance; it is the percentage of the seabed that is covered with coral. The measure reduces after major cyclones, when coral-eating starfish numbers increase, and after some bleaching events. Coral cover at a given location usually takes five to ten years to recover from these events. Coral cover on an individual reef can drop to just a few percent after a major mortality event. It fluctuates naturally with time.

AIMS and the reef surveys

Since 1986, the Australian Institute of Marine Science (AIMS) has surveyed roughly 100 of the 3000 coral reefs of the Great Barrier Reef (GBR). The data is published on its website.[1]

The data is broken into three regions: Northern, Central and Southern. These regions are broken down further into 'sectors', with 3, 5 and 3 sectors in the Northern, Central and Southern regions respectively. For each of the 11 sectors, there are roughly 5–10 individual coral reefs surveyed each year. The survey for each reef is performed by towing a diver around the perimeter of each reef. The diver observes coral cover over a 140-m distance and estimates the percentage cover. The perimeter of each reef is many miles long, so there could be 50–100 sample transects for each reef.

The coral cover for each reef is an aggregate of the figures of all the 140-m-long sample points. The cover for each sector is an aggregate of all sampled reefs in the sector. The cover for the three regions can be calculated by aggregating the data from the contributing sectors.

The sector data for 2022, as found on the AIMS website, is shown in Table 1.

Table 1: Great Barrier Reef coral cover by sector.

Uncertainty estimates vary, but are typically between 5 and 10% according to the AIMS graphs for an individual sector.

Sector	2022 cover (%)
Cape Grenville	47.0
Princess Charlotte Bay	41.0
Cooktown/Lizard Island	25.3
Cairns	29.5
Innisfail	15.6
Townsville	34.7
Cape Upstart	30.0
Whitsunday	37.4
Pompey	31.8
Swains	21.8
Capricorn Bunkers	58.6
Average (unweighted)	33.9

Why coral is not 100% on a coral reef

Coral cover is the percentage of the seafloor covered with coral. It is often assumed that coral cover should be 100% on a healthy coral reef. However, a reef is made of many different ecosystems. These include coral sand made from broken down coral, ancient dead coral 'rock', soft corals, algal beds, and the hard crustose coralline algae that help cement together the dead coral on a reef. Dead coral is like concrete – it does not rot like wood. Coral grows on the dead bodies of their ancestors, and in doing so build 'reefs". Most of the reefs of the GBR have built up 50 to 100 meters above the surrounding seafloor in the last million years.

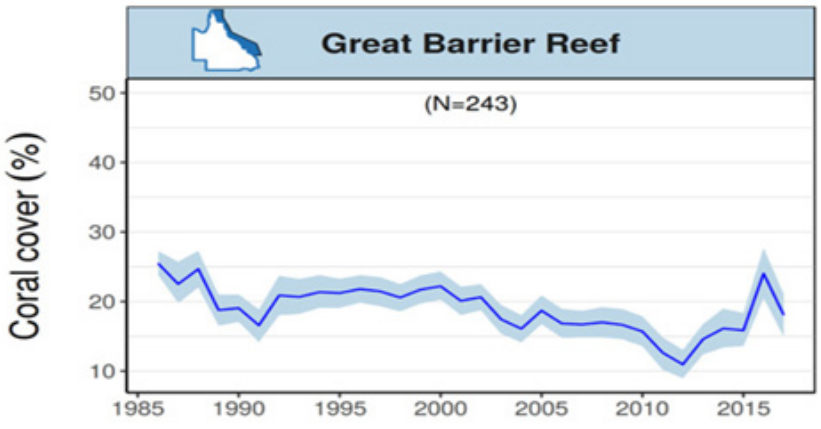
Coral cover in the reef as a whole

Up to 2017, AIMS published the average for the Great Barrier Reef. The relevant graph, taken from the report for 2016/17 is shown in Figure 1. However, ever since, it has only issued disaggregated figures.

Its explanation, although never stated formally, is that it does not regard a single figure (the average) as representative of

Figure 1: Aggregate GBR coral cover 1986–2017.

As published on the AIMS website. This was the last year it published aggregate data.



the full diversity of the conditions on the reef. That is correct, but the average is nevertheless an interesting statistic, and the region, sector, reef and 140-m transect data is available for anyone wanting a more detailed discussion.

AIMS is also being inconsistent. It aggregates transect data to produce a single number for each surveyed reef. It aggregates reef data to produce a single number average for each sector. It aggregates reef/sector data to produce a single number average for each region. So why does it not aggregate reef/sector/region data to produce a single number average for the entire GBR?

Nevertheless, AIMS should be congratulated. Over the last 30 years, it has now towed divers a distance roughly equivalent to the circumference of the world. The result is a remarkable dataset.

Reconstructing the missing averages

With the sector data freely available, it remains straightforward to prepare an average coral cover figure for the whole GBR, for 1986 to 2022. This is shown in Figure 2. The average as at 2022 is found to be 33.9%, with an uncertainty of about 4 percentage points. This assumes equal weighting of each sector. This is the highest level on record.

Figure 2 makes it clear that AIMS has effectively hidden the very good news about the reef between 2016 and 2022 by not publishing the GBR average data since 2017. It is very unusual for all three major regions, and almost every sector, to be well above average at any moment in time. For example, the waves caused by a large cyclone will often kill large amounts of coral over a vast region, so some sectors are often recovering from such an event and have low coral cover. Only by seeing all the data ag-

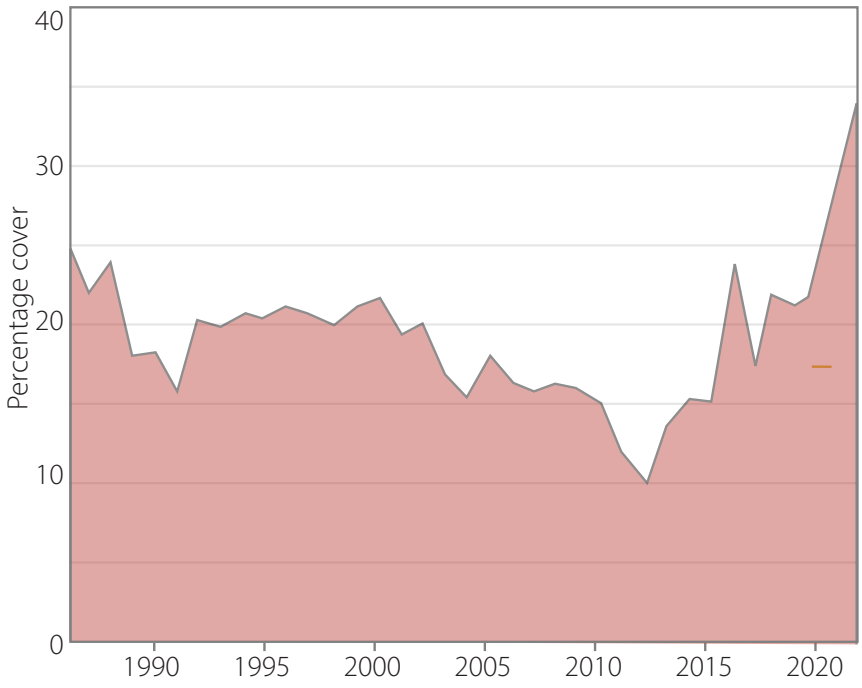


Figure 2: Aggregate GBR coral cover 1986–2022.

Prepared by the author. AIMS averages are used for 1986–2017, with the figures for subsequent years prepared from the sector data in Table 2.

gregated as an average for the entire reef can the exceptional state of the coral cover be appreciated. AIMS shows graphs for all three regions, and all have very high coral cover – but none are record-breaking highs. Because there is roughly a 1-in-3 chance that a region has very high coral cover, there is only a 1-in-27 chance that *all three* are high simultaneously, as is the case in 2022.

It is surprising that AIMS no longer provides an average coral cover for the entre GBR, because they have previously made far reaching claims about its poor state based on reef-wide average data. For example, when the coral cover hit a low point of around 10% in 2011, after major cyclones destroyed large amounts of coral, AIMS authors De'ath et al. (2012) wrote in a very high-profile paper, that was widely quoted in the world media, the following:

> Without significant changes to the rates of disturbance and coral growth, coral cover in the central and southern regions of the GBR is likely to decline to 5–10% by 2022. The future of the GBR therefore depends on decisive action. Although world governments continue to debate the need to cap greenhouse gas emissions, reducing the local and regional pressures is one way to strengthen the natural resilience of ecosystems.

This prediction of 5–10% for 2022 has clearly turned out to be incorrect; as we have seen, the average coral cover for all the regions is now over 30%. By no longer publishing the GBR average, AIMS has obscured the good news for 2022, and drawn a veil over their inaccurate prediction of a decade ago.

Final comment

The latest data on the GBR indicates it is in good shape. It happens to have a great deal of coral in 2022 because there have been few major mortality events over the last five to ten years. The three or four bleaching events since 2016, which have been widely reported in the media, could not have killed much coral, otherwise the 2022 statistics would not be so good.

The data since 1986 shows that every region, every sector and most reefs have had occasionally had periods of very low coral cover for one reason or another. This is entirely natural. The media makes much of occasional setbacks to coral cover, but a measure of the health of an ecosystem is the ability to recover from a major stress. Frail systems will not recover, robust systems recover well, just as healthy people recover quickly from disease.

The GBR has proven to be a vibrant and healthy ecosystem. This should not be a surprise; there are few human pressures on the reef, and it is well protected. It is also unreasonable to expect that the small temperature rise over the last century (1°C) will have caused much impact, especially as it is well known that most corals grow faster in warmer water.

The data collected by AIMS shows that the GBR is a robust system with rapidly fluctuating coral cover. We must expect that, sometime in the future, a sequence of events will cause the coral cover to fall sharply, as it did in 2011. We must then remember that this is almost certainly natural, and not allow the merchants of doom to depress the children.

Table 2: Coral cover by sector and region, 2017/18–2021/22

Sectors	2017/18	2018/19	2019/20	2020/21	2021/22
Cape Grenville	23.8	26.4	29.2	34.6	47.0
PCB (Princess Charlotte Bay)	20.4	20.5	16.3	26.9	41.0
Cooktown/Lizard Island	9.0	10.2	12.8	21.4	25.3
Cairns	14.6	13.1	13.5	22.9	29.5
Innisfail	10.4	12.3	10.2	13.3	15.6
Townsville	19.4	18.8	19.6	26.6	34.7
Cape Upstart	24.2	24.2	24.2	25.8	30.0
Whitsunday	29.6	24.4	24.4	29.3	37.4
Pompey	20.2	18.5	25.1	33.4	31.8
Swains	29.7	20.4	24.2	25.4	21.8
Capricorn Bunkers	39.4	49.1	44.5	52.6	58.6
GBR average assuming equal weight by sector	21.9	21.6	22.2	28.4	33.9
Regions					
Northern Region Grenville, PCB, Cooktown/Lizard Island	17.7	19.0	19.4	27.6	37.8
Central Region Cairns to Whitsunday	19.6	18.6	18.4	23.6	29.4
Southern Region Pompey, Swains, Capricorn Bunkers	29.8	29.3	31.3	37.1	37.4

Source: AIMS data. Shaded entries indicate sectors not surveyed. The results of the previous survey have been used instead.

Note

1. https://www.aims.gov.au/docs/research/monitoring/reef/latest-surveys.html

About the Global Warming Policy Foundation

People are naturally concerned about the environment, and want to see policies that protect it, while enhancing human wellbeing; policies that don't hurt, but help.

The Global Warming Policy Foundation (GWPF) is committed to the search for practical policies. Our aim is to raise standards in learning and understanding through rigorous research and analysis, to help inform a balanced debate amongst the interested public and decision-makers. We aim to create an educational platform on which common ground can be established, helping to overcome polarisation and partisanship. We aim to promote a culture of debate, respect, and a hunger for knowledge.

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