

Beyond the Barrier Reef: Australia's three other World Heritage reefs are also in trouble

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The Great Barrier Reef is world famous—it's the largest coral reef system in the world and home to tens of thousands of species. No wonder it is World Heritage listed.

But Australia has three lower profile reefs that are also World Heritage listed—Ningaloo and Shark Bay in Western Australia, and Lord Howe

Island, 600 kilometers off the New South Wales coast, the [southernmost coral](#) in the world. Ningaloo has 260 km of coral reef, while the reefs of Shark Bay have less coral but are home to ancient stromatolites, vast seagrass beds and iconic species such as dugongs.

This month, the World Heritage Committee will meet in New Delhi. On the agenda will be how the world's natural World Heritage sites are faring. The Australian government will be under increased scrutiny to prove it has upheld its [international commitments](#) to protecting these reefs.

Our [new research](#) has found all four of these reefs are in greater danger than we thought—even those in subtropical waters, such as Lord Howe Island. Our two Indian Ocean reefs at [Shark Bay](#) and Ningaloo actually face more species and function loss than the Great Barrier Reef.

At 1.5°C of warming, we are likely to lose about 20% of the 400-odd coral species which currently live across these four reefs (equating to about 70 extinctions). At 2°C warming, our modeling of species abundance and ecosystem functions predicts an almost complete collapse in reef ecosystems—even for the subtropical reefs. This aligns with [predictions](#) by the Intergovernmental Panel on Climate Change for the future of coral reefs.

We believe our work adds to the need to consider whether Australia's four iconic reefs should be [on the list](#) of World Heritage sites in danger.

What does it mean when a reef is World Heritage-listed?

Declaring a natural or cultural site as World Heritage is done to encourage the preservation of locations of immense ecological and

cultural value. Nations have to [nominate sites](#) they think are worthy of protection. Australia has 20 World Heritage sites, [of which](#) 12 are natural.

When sites are formally listed, the United Nations Educational, Scientific and Cultural Organization (UNESCO) requires the country's government to monitor and care for it. If the site is degrading, it can be listed as in danger.

UNESCO has considered listing the Great Barrier Reef as in danger twice, in 2021 and again in [June this year](#). For the reef to keep its World Heritage status, the government must prove its policies are sufficient to keep the reefs in [good health](#).

In the debate over the Great Barrier Reef, two things have been missed—first, any mention of Australia's other World Heritage reefs, and second, whether the federal government's current policies to cut greenhouse gases are enough to protect the reefs into the future.

What did we find?

Our new results suggest all four reefs are in trouble. Given current warming trends, they will only deteriorate further in the future if we stay on this course.

While the Barrier Reef has drawn a great deal of attention, it's actually the ecosystems at Ningaloo, Shark Bay and Lord Howe Island that are projected to warm the most. When standardized to park boundaries, temperatures here are projected to increase by up to 1.3°C by the end of the century. (This temperature estimate is for [sea temperatures](#), not the overall surface temperature which we use as shorthand when we talk about 1.5°C or 2°C of warming).

While that might not sound like much, it will be enough to push many corals to potential extinction. Many coral species already exist within 1-2°C of the maximum temperature they can tolerate.

Our modeling shows that Shark Bay and Ningaloo actually face a greater risk of species and function loss than the Barrier Reef. It also suggests the ability of our reefs to bounce back will be overcome when warming tips over 1.5°C globally.

While these models incorporate the baseline heat tolerance of coral species on these reefs, they don't yet include their [potential for genetic adaptation](#). The question of whether some corals could adapt to this rapid warming is still open. A lot is riding on their ability to do so.

Looming danger

This year, the Great Barrier Reef and [Lord Howe Island](#) have suffered intense stress from high sea temperatures—the direct result of burning fossil fuels and producing heat-trapping greenhouse gases. This year is [on track](#) to again be the hottest year on record, overtaking the previous record holder of 2023.

Australia is already in the midst of an extinction crisis. Australia has one of the worst track records for extinctions. Since European colonization, 34-38 mammal species have [gone extinct](#) compared to just one from the contiguous United States, which covers a similar area.

You might have read that coral cover—a measure of how much coral there is in an area—[hit historic highs](#) on the Great Barrier Reef last year.

Coral cover is a helpful and important metric, but it's not perfect. For instance, fast-growing heat-tolerant coral species might expand as less heat-tolerant species die off. Importantly, relying on coral cover alone

can mask significant changes in how the [reef is functioning](#).

It's hard to assess how species in our oceans are doing, given the difficulty of access and the large number of species, including many unknown to science. If warming continues unabated, we will likely start to lose [species](#) before we have even documented them.

Our results are based on "moderate" climate models of global surface temperature changes. Australia has committed to cutting emissions by 43% below 2005 levels by 2030. While that sounds good, it's not enough—this decrease is compatible with [hitting 3.2°C by 2100](#). To limit warming to 1.5°C or below by 2050, we would need to commit to much greater cuts in emissions—90% below 2005 levels by 2030.

Our results clearly suggest that Australia's four World Heritage reefs will be dramatically affected by warming in the near future. They will no longer qualify as being maintained under "conditions of integrity." It's hard to see how they can avoid being added to the in-danger list.

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