Our grandchildren may never see the Great Barrier Reef recover

By Alice Klein, *New Scientist*, print edition of April 21, 2018

THE Great Barrier Reef has been so severely damaged by record ocean heat that it will never be the same again in our lifetimes or those of our grandchildren. With ever hotter ocean heatwaves set to occur every few years, the reef will have no chance to recover fully.

"In 30 years' time, we'll still have a reef, but it will look very different," says Terry Hughes at James Cook University in Australia, whose team has conducted surveys of the reef to assess the damage.

We already knew that the iconic reef was badly damaged by recent heat events. Hughes's surveys show that the corals started dying at far lower levels of heat stress than expected. They also show that the structure of a third of the 4000 individual reefs that make up the Great Barrier Reef has been degraded, altering ecosystems.

The current damage began with a fierce ocean heatwave in early 2016, which directly killed many corals. Overall, 30 per cent of coral cover was lost, making it the worst die-off on record. A second heatwave at the start of 2017 then killed another 20 per cent. While some areas have recovered, corals are still dying in the worst-hit regions.

Alarmingly, the corals' tolerance of short periods of very high sea temperatures or of longer periods of less severe heat was just half as much as forecast by NASA and other research teams (*Nature*, doi.org/cngq).

The corals also died faster than predicted. After sea surface temperatures reached record levels in March 2016, for example, millions of corals perished in just two weeks. "They simply cooked," says Hughes. "We'd never seen anything like it."

Others died more slowly over the following months after bleaching – expelling the algae that provide much of their food, and also give them their colour.

Some coral species were harder hit than others. For example, in the northern section of the reef, which was worst affected in 2016, more than three-quarters of staghorn and table corals were wiped out, whereas most dome-shaped corals emerged unscathed.

This is problematic because dome-shaped corals don't provide the same protection to fish as intricate staghorn and table corals, says Hughes: "They don't create the same nooks and crannies for hiding in."

This shift has already affected fish diversity, according to a study by Laura Richardson at James Cook University and her colleagues. They found a sharp decline in the number of butterflyfish, for example, which are highly dependent on staghorns.

In the best-case scenario, some of the corals will bounce back, says Hughes. So far, 2018 has been mild, allowing surviving fragments to start re-sprouting.

These survivors may be better equipped to handle future extremes, says Hughes. “The ones left over should be tougher because they’ve survived two mass casualty events now,” he says. “It’s basically been a huge natural selection event.”

Line Bay at the Australian Institute of Marine Science agrees this is possible. Her team is investigating whether the corals that survived have genetic variants that help them cope better with heat stress.

However, even if the surviving corals can tolerate the same levels of heat that the reef endured in 2016 and 2017, they could struggle as ocean temperatures rise above that under climate change. Mass die-offs are likely to continue for at least the next century.

This means the reef won’t get a chance to recover fully. Even the fastest-growing corals take a decade to reach their full size, says Hughes, and severe heatwaves are predicted to strike every five years or so due to global warming. The mix of species making up a reef will also continue to shift, he says.

The fate of the Great Barrier Reef depends on how quickly we slow climate change by reducing greenhouse gas emissions, says Hughes. “The endpoint for the reef won’t be extinction if we get our act together now,” he says.

In January, the Australian government pledged an extra A$60 million in funding to help the reef. This will go towards removing crown-of-thorns starfish that eat the coral, reducing pollution running into the sea from nearby farms and researching ways to transplant healthy corals onto damaged parts of the reef.

The latter is controversial, says David Suggett at the University of Technology Sydney. “There’s a school of thought that says we shouldn’t be interfering with the reef, we should just be solving the underlying climate change problem,” he says. “But if you think of the reef like a patient with a terminal disease, I think it’s worth looking for ways to treat the symptoms while we’re still looking for the cure.”

Selina Ward at the University of Queensland welcomes the extra funding, but says the Australian government isn’t doing enough to tackle greenhouse gas emissions.

Australia is doing less than most other rich countries to reduce emissions. Its government also supports coal projects, including the planned Carmichael coal mine just 300 kilometres from the Great Barrier Reef.

“We can’t have our government saying, ‘let’s wait 10 years, let’s approve this huge coal mine, let’s extend the life of coal-fired power stations’,” says Ward. “The reef just doesn’t have time for that.”

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