WHAT IS THE STATUS OF ONE OF THE WORLD'S SEVEN NATURAL WONDERS?

DINI MARTINEZ

Is there hope for the Great Barrier Reef?

ALTHOUGH sailing to faraway places is an almost constant temptation for most cruisers, the current state of the world seems to invite us to turn our attention to local destinations, at least for the time being. Luckily, we have one of the seven natural wonders of the world right at our doorstep.

The question is, for how much longer?

Bigger than Italy and visible from outer space, the Great Barrier Reef (GBR) spans over 2,300 kilometres along the Queensland coast. It consist of more than 3,000 connected reefs, about 900 islands and counts well over 15,000 species, including 1,625 different fish, 3,000 varieties of mollusc, 450 species of coral, 220 unique birds and 30 types of whales and dolphins.

This incredible diversity and the importance it plays in broader ocean health has gained the GBR the nickname of the 'rainforest of the sea'. Our reef is the biggest breeding ground for humpback whales and green turtles, as well as being home to one of the world's largest populations of dugongs.

Worldwide, a quarter of all marine creatures depend on reefs for their survival, despite covering less than two per cent of all ocean floor. When in 1981 the UN declared the GBR a world heritage site, it asserted it to be "the most biodiverse of all world heritage sites" and of "enormous scientific and intrinsic importance".

INTRINSIC, CULTURAL AND ECONOMIC SIGNIFICANCE

Economically, around 65,000 Australians depend on the reef through industries like fishing and tourism. The latter employs 91% of reef-dependent jobs and accounts for $6 billion annual revenue alone.

Traditionally, over 70 Aboriginal and Torres Strait Islander groups have maintained a continuous relationship with the reef for over 40,000 years. One dreamtime story tells of two brothers who went off to hunt beyond their territory. This breach of the Law made Father Sky so angry that he caused the earth to tremble. The resultant volcanic activity created what we know today as the Great Barrier Reef.

Scientists consider the earliest evidence of complete reef structures to be 600,000 years old. The current living formation is believed to have begun growing on the older platform about 20,000 years ago.

Aerial Survey exposing the bleaching damage in March 2020.

As sea levels rose and fell through the ages, the GBR has built itself into a vast labyrinth of deep and shallow-water reefs extending 230 kilometres off the Australian east coast and ending in an outer wall that plunges half a mile into the abyss.

CORAL 101

To be able to appreciate the current health of our reef, it is necessary to understand the basics of its number one constituent: corals. These billions of polyps are a living organism, which rely heavily on the relationship with a photosynthetic plant-like algae.

If waters warm too much, the coral polyps expel its symbionts and turn white or fluorescent. At this point they are not dead yet. If temperatures decrease again before too long, the algae moves back in and everyone recovers.

However, if elevated ocean temperatures last for months, the coral starves to death. This produces sad pictures of decaying corals covered in slimy growth and desperate fish looking for a new home.

A DRAWN-OUT DEATH

In 2016 a GBR obituary was published in an American outdoor magazine. It was widely criticised for being premature. However, the following five years have proven detrimental.

Three, almost consecutive, bleaching events interspersed with six cyclones created unprecedented damage. Some low-lying reefs in the Whitsundays lost up to 97% coral cover with Cyclone Debbie in 2017 alone.

The 2016 bleachings affected mainly the northern part of the reef and destroyed about a third of all coral, including an almost complete stretch of 800 kilometres. Merely a year later, aerial surveys estimated that elevated ocean temperatures once again triggered a similar death rate. This time it concentrated on the mid-section of the reef.

Then, in early 2020, the third mass bleaching event in five years would have been the number one headline had it not been for Covid. Leading reef scientist Professor Terry Hughes assessed the condition of the GBR in a series of aerial surveys in March and found that bleaching was more widespread than in any of the previous years.

2020 struck the northern, central and large parts of the southern sections of the reef, which up to then had been mostly spared. For instance, Dickson Inlet near Cairns or Geoffrey Bay in the Magnetic Islands, both previously characterised by high coral cover, are now dominated by algae and sediment. Signs of flow-on effects to fish populations are becoming more and more evident.

LEFT TO RIGHT: Agriculture in Queens Bay, Bowen. Image courtesy GBRMPA.

NASA images from pesticide run off 100 kilometres offshore into the reef.

Map of the Great Barrier Reef region.

In good conditions, it takes a reef about ten years to recover from a severe bleaching event. If one reef is knocked out, there are usually plenty of adults in adjacent reefs to provide juveniles.

However, now "the scale of mortality is such that there is nothing left to replenish the reef" says Professor Andrew Baird from the ARC Centre of Excellence for Coral Studies.

An international collaboration of scientists' research study from 2020 found an 89% decrease in new corals, compared to 1990s levels. It also notes that the mix of baby coral species has changed.

Some scientists are describing it as the early stage of a huge natural selection event.

OR BATTLE OF SURVIVAL?

Despite recent disasters, many reefs are still stunningly beautiful, such as the area around the Palm Islands north of Townsville. Generally speaking, the outer and deeper reefs have fared better and most of the major tourist destinations have mostly dodged the bullet too. Plus there are a few scattered 'super reefs' that scientists are avidly exploring to find out what makes them such survivors against all odds.

Dr. Anne Hoggett, director of the Lizard Island Research Station has observed "quite amazing levels of recovery since the 2016 and 2017 bleaching events" around the Lizard Island archipelago. Although a welcome demonstration that reefs can regenerate themselves after extreme damage, the question remains: how long can they continue to do so in a world where conditions that cause such extreme damage occur with increasing frequency?

Many scientists are worried that before too long reefs will be experiencing severe bleaching almost annually.

MORE THAN ONE BATTLE

As if climate change and its direct consequences like increased cyclone occurrence and intensity was not enough, the reef has had to face other attacks over the past decades.

Seemingly regarded as a mere limestone forest, in the 1960s the Queensland government considered selling it off to south east Asia or turn it into Chinese cement. It also considered leasing the entire reef to oil and mining companies.

This gave birth to the 'Save the reef' campaign that culminated in 1975 when responsibility for water and natural resources was transferred to the federal government. It also saw the creation of the Great Barrier Reef Marine Park, which has been trying to restrict fishing, shipping and development in the region ever since.

Alas, several disasters have continued to hit the reef, like hundreds of tons of nitrate-laden waste water discharged by nickel mining company both in 2009 and 2011; or extensive damage from the bulk coal carrier Shen Neng 1, which spilled four tons of oil when it ran aground on Douglas Shoals in 2010 and almost shipwrecked.

Despite the reef's condition continuing to deteriorate, in 2016 the Australian government pressured the United Nations to remove a chapter about this concerning deterioration from a report on the impact of climate change on world heritage sites.

MINING, COAL AND POLITICS

More recently still, despite significant public upheaval, the official OK has been given for Adani's controversial $16 billion Carmichael mine.

Correspondingly, the extension of the Abbot Point coal port has also been approved, doubling its capacity to ship the mine's coal through the reef to be burnt off in power stations in India. A mere 19 kilometres from the GBR's closest corals, this high conservation area is home to dugongs, snub fin dolphins, thousands of endangered bird species, and turtle nesting beaches.

All of the six species of marine turtles that live on the reef are listed as threatened. These developments create risks for them

"A GBRMPA SPOKESPERSON STRESSES THAT "EVERY EFFORT, NO MATTER HOW SMALL, COLLECTIVELY MATTERS"

and other wildlife, the habitat, ecosystem conservation, water pollution and, last but not least, will continue to fuel and exacerbate climate change.

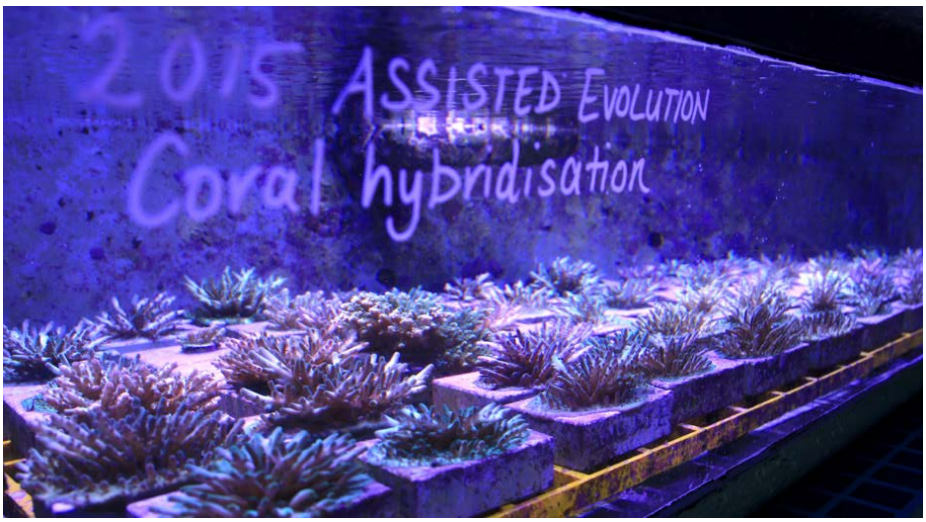
Scientists have flagged to state and federal governments that fossil fuel projects such as coal or gas are not compatible with a healthy reef. Even economists, banks and insurance companies are increasingly shifting their investment focus towards renewable energy as the sensible answer to stimulate the economy while cutting emissions.

FARMING RUN-OFF AND COASTAL DEVELOPMENT

The latest Reef Outlook Report notes that pollution reduction has been slow. Poor water quality continues to affect many inshore areas and improvement targets in agricultural land management practices have not been met.

Around 80% of the land adjacent to the GBR is used for intensive cropping of sugar cane, beef cattle grazing and other potentially-harmful farming.

Early 2019, unprecedented flood run-off near the Whitsundays and Cape Tribulation spanned out 60 kilometres and more from the Queensland coast to the outer reefs. Such incidents spread potentially harmful chemicals like lead,



copper, mercury and arsenic into the ocean while also increasing turbidity that restricts growth.

This resultant murky water allows less sunlight to reach the photosynthesis-dependent corals and seagrass, further degrading the already compromised ecosystems.

Dire consequence are exacerbated by the loss of coastal wetlands, which act as a natural filter for toxins and help deposit sediment.

Moreover, coastal developments create more pollution, which has caused significant harm to some already struggling marine wildlife, with particular concern for the future of the loggerhead, hawksbill and northern green turtles.

CROWN-OF-THORNS STARFISH

Poor water quality allows crown-of-thorns starfish to thrive. A single one can grow up to 80 centimetres in diameter, eat up to eight square metres of coral per year and females can lay up to 65 million eggs each spawning season.

It is in a healthy reef, this native species helps to keep bigger corals at bay, thus making room for smaller, more diverse corals to grow.

However, when populations become unbalanced, large outbreaks of thousands of starfish can invade a hectare of the reef and destroy up to 97% of coral population. Such invasions can be so severe that, even if a reef is not affected by any other disturbances, it can take a decade to recover.

The GBR has been experiencing an outbreak since 2010. Most heavily affected areas have shifted from reefs offshore of Cairns to those of Innisfail and Townsvilleand the Swain Reefs.

OVERFISHING

Aggravating the issue has been the overfishing of some of the starfish's predators such as the giant triton. Examples of disrupted food chains are plentiful.

The overfishing of grouper, another key reef species, has been compared to the removal of wolves from Yellowstone. The decimated number of groupers has allowed one of its favourite feeds, the damselfish, to reproduce disproportionately. The damselfish creates pockets in coral to facilitate algae growth which, in some parts, is now taking over already damaged reefs.

Despite numerous attempts, many threatened species of fish and marine life continue to be caught due to illegal fishing and both commercial and recreational by-catches.

SHARK CULLING

Another human intervention in the reef's ecosystems has been the Queensland government's shark culling program. Lethal drumlines have been installed in and around the marine park since the 1960s, killing around 50,000 sharks, as well as double as many other marine animals.

ABOVE: Hybrid corals created through assisted evolution

LEFT TO RIGHT: Bleached reef around the Keppel Islands.

Dr Veron collecting coral.

John Rumney Dr Charlie Veron and Dr Dean Miller with coral collection.

In 2019, a Federal Court decision ordered the Department of Fisheries to stop killing 19 vulnerable species caught in its 173 drum lines offshore. Nevertheless, in early 2020 several drumlines that had been removed a year earlier were returned despite less than a handful of annual shark sightings at any of the region's most popular beaches and many scientists agreeing that this is not an effective method to reduce the risk of shark attacks.

OUTLOOK

The Great Barrier Reef Marine Park Act demands an independently verified outlook report on the GBR's health be published every five years.

The 2009 Report stated the reef was "at a crossroads between a positive, well-managed future and a less certain one". The 2014 version called the reef "an icon under pressure" with "efforts needed to fight key threats". Since then, the region has further deteriorated.

The most recent 2019 report has downgraded its long-term outlook to "very poor" and notes that "Australia is caring for a changed and less resilient reef".

Impacts of climate change represent by far the most significant threat to the reef. Paradoxically, the latest report was published on the same day the federal government released its quarterly emissions data, which have continued to rise for five years in a row.

Right now, Australia's emissions are neither consistent with holding global levels below a warming of 2 degrees Celsius, nor complying with the Paris Agreement on greenhouse gas emissions reductions.

CAN WE SAVE THE REEF?

It is not all gloom and doom. Although with each closely followed bleaching event the reef becomes more fragile, there is high variability in bleaching overall.

It is this patchiness that creates hope, together with some other success stories like the recovery of humpback whale populations after international bans on whaling plus, at least, some success on Raine Island to save green turtle populations which, at one point, seemed to be sprinting towards extinction.

Also, overall, an estimated 40% of the 348,700 square kilometres making up the reef have experienced little to no bleaching. A GBRMPA spokesperson urges visitors to continue to come "to see the reef, love the reef, and protect the reef".

Two hundred and eighty public moorings specifically invite cruisers to do so.

CORAL IVF

To increase heat tolerance, researchers and scientists have been testing many approaches such as coral IVF, cross-breeding, micro-fragmentation and genetically manipulating corals as well as the symbionts. Most of these strategies have yet to prove themselves outside the laboratory and on a scalable basis. Coral scientist Madeleine van Oppen admits that "playing god" has its risks, yet "not doing anything appears even riskier".

Some projects have had a high success rate, such as growing corals faster in labs to then reintroduce them and jumpstart depleted reefs.

Dr. Emma Camp from the University of Technology in Sydney had her scientific breakthrough moment in 2016 when she discovered reefs in New Caledonia, which were thriving despite low ph levels and elevated temperatures characteristic for climate change.

Based on these observations, in late 2017 she and the head of the Future Reefs program,

LEFT: Merlin

BELOW LEFT: COT pest management in Far Northern Queensland.

OPPOSITE PAGE: Overfishing

Professor David Suggett, transplanted similarly resistant corals from a mangrove forest off Port Douglas to the GBR's Low Isles with initial promising results.

Making use of existing resources, in June 2020, the Great Barrier Reef Foundation's Island Initiative planted 600 corals in just two days while upskilling Whitsunday tourism operators who had all lost their jobs due to Covid.

Another new partnership between tourism and science, the Coral Nurture Program, together with five tourism operators, have out-planted over 16,500 corals in 50 coral nursery frames. While this will not save the reef, the project aims for "long-term stewardship".

Similar scaling limitations apply to the cloud brightening project by the Southern Cross University, whereby massive turbines spray seawater out from moving boats along bleaching affected reefs to keep water temperatures cooler.

A slightly more scalable project has been capturing millions of coral larvae in floating pools protected from predators. After five days, when the embryos reach about fingernail size, they are released over deteriorated reefs.

Yet, given the scale and diversity of the reef, even with the best intentions and best success rates, all these projects can do at best is buy some years.

THE CORAL ARCH

In this race against time, longstanding reef saga Dr Charlie Veron has joined the GBR Legacy in its efforts of building a 'living coral biobank', which according to the organisation's managing director Dean Miller, "is the only solution for maintaining the genetic diversity of both corals and their symbionts".

This one-of-its kind 'coral ark' is kept alive in a holding facility in Port Douglas, as well as public and home aquarium collectors who hold and maintain backup fragments all over the world "creating

the largest collaborative preservation network of corals".

Dean points out that with every consecutive bleaching event "we are losing the most vulnerable coral species and therefore biodiversity". The corals that have shown more resilient in the face of recent bleaching events are "very few in terms of species".

To aid the fight against what coral lover Zoe Richards has deemed a "silent extinction", the former Olympian David Forbes has donated his well-known Merlin. In late 2019, the GBR Legacy team sailed the 51-foot McConaghy yacht from Sydney to her new home in Port Douglas while collecting scientific ocean data for various universities and agencies around the world.

They also ran education programs from the yacht, including around the importance of biodiversity on this planet.

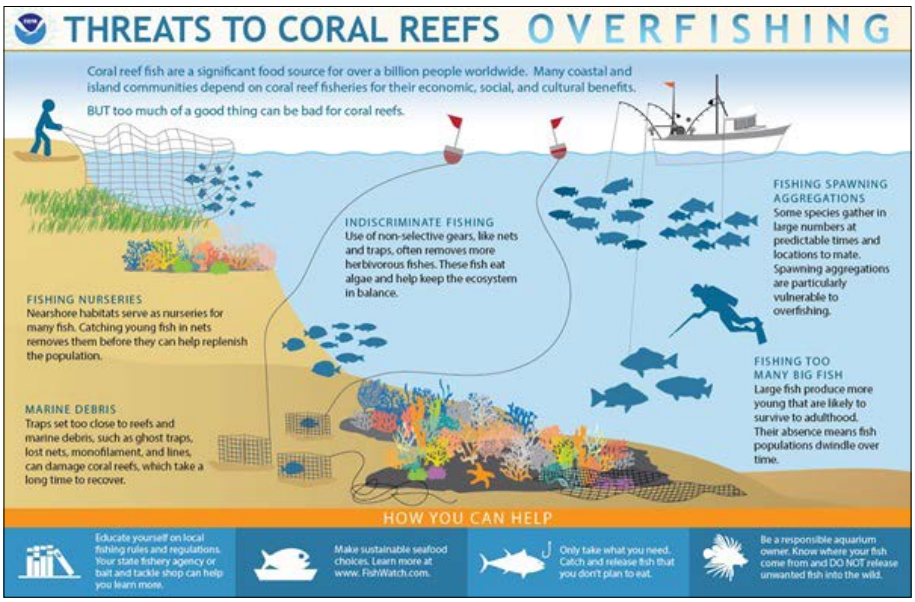
The British broadcaster and natural historian Sir David Attenborough has repeatedly been pointing out that all of the world's ecosystems are based on healthy oceans. "If that part of the planet becomes dysfunctional, then the whole life on this planet will suffer".

CLIMATE CHANGE ACTION

If we continue with life as we know it, the reef is likely to disappear within a generation. Luckily, great ideas and new technology are becoming more and more economically viable. However, to become scalable most climate solutions need a more enabling environment, including stronger climate policies and higher prices on carbon.

Imogen Zethoven, director of strategy for the Australian Marine Conservation Society, adds: "we can turn this around, but only if the prime minister cares enough to lead a government that wants to save it. And saving it means being a leader here and internationally to bring greenhouse gas emissions down."

The coronavirus pandemic has not only drastically reduced global emissions, at least temporarily, but also proven that if sufficient leaders care enough, radical changes can happen very quickly. If post-cCovid economic stimulus packages focus on facilitating the transition to a low-emissions economy there is hope.



VOLUNTOURISM

The Reef's enormity makes gathering any meaningful amount of data challenging and key gaps remain for many species and habitats.

Such lack of information is concerning, because declines may not be evident until critical thresholds are exceeded.

Authorities have been relying heavily on aerial surveys, which are limited in depth and detail. Luckily, the resources for gathering more comprehensive on-the-ground data already exist, namely the thousands of boats and people visiting the reef every year.

Most of these people are citizens just like you and me: cruisers, divers, snorkellers, tourists.

CoralWatch, the Reef Restoration Foundation's volunteer program, Eye on the Reef and Redmap are just some of many platforms that tap into this diverse net of resources by allowing citizens to be scientists through education and participation.

With things like the Coral Health Chart anyone out on a reef can upload information and photographs to a global database, which ultimately informs NGOs, authorities and policy makers.

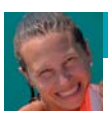
So far over 6,000 GBR visitors have used the tool flagging deteriorating areas of the Reef. Marine biologist Natalie Lobartolo explains that this enables "tourism where you're contributing to something a little bit bigger."

OUR WINDOW OF OPPORTUNITY IS NOW

The message from almost everyone involved is clear: our window for action is now. If we miss this opportunity, we will lose the reef and "consequences are going to be far bigger than covid" warns climate scientist Lesley Hughes.

- reduce waste, eat less meat, drive and fly less, and become more resource-aware
- vote for parties who take environmental protection and climate change seriously
- volunteer for one of the reef protection projects such as the Australian Marine Conservation Society's Fight for our Reef campaign, the GBR Legacy's Coral Biobank or any of the other initiatives
- put our money into banks, supers and insurance companies that will not invest in projects that threaten the environment and our reef.

A GBRMPA spokesperson stresses that "every effort, no matter how small, collectively matters". ≈



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Dini lived for some years with her family on their Moody 425 cruising the Med. Currently they are back in Sydney with a young family, before hitting the Caribbean and the Pacific before too long. More on their journey and yoga events Dini runs worldwide: SailingYogaFamily.com.