The coral bleaching signals a defining environmental shift

BY JO CHANDLER

Many of today’s marine scientists blame Jacques Cousteau, who surfaced in their lounge rooms during their formative years, for luring them into the water. Others were hooked by the psychedelic barrage of coral gardens and sea creatures in National Geographic. Through the ’60s and ’70s, the co-evolution of scuba technology, underwater photography and colour television took millions of earthlings on their first beguiling voyage into the deep.

Until then, the submarine world was, for most people, as remote as the just-trodden Moon. For the University of Queensland’s Professor Justin Marshall, however, terrestrial life was never really on the cards. His father was Dr Norman Bertram “Freddy” Marshall, “curator of Her Majesty’s fishes” at the British Museum (Natural History), and his mother, Olga, was a scientific illustrator who captured her husband’s discoveries in ink and watercolour. Young Justin was the marine-science equivalent of an army brat, floating around research bases in the Bahamas and Florida between stints at an Essex house where pickled specimens from the world’s oceans were collected, lifeless and eternal, in jars. “I was a nerdy little bugger,” Marshall recalls, “correcting graduate students at age seven on the Latin names of fish.”

Marshall grew up to become a neuro-ecologist investigating how residents of coral reefs and the deeper ocean perceive their environment. “As arrogant humans we tend to assume we are the pinnacle of evolution; however, certainly in sensory terms, this is far from true,” he explains in his professional profile. He tells me he works with these creatures “because I love them.” And, as it happens, they have much to teach. “The animals I’m working on at the moment are helping us detect cancer, increase data storage on computers and improve satellite design. All coming directly from mantis-shrimp vision.”

The blue-grey surface of the ocean is a formidable barrier. But for Marshall it was always pervious. “I’ve lived underwater, done two stints in the Aquarius habitat [a submerged laboratory in the Florida Keys]. I’ve fallen asleep underwater, which you’re not supposed to do.”

On 16 March he wept underwater. “It was on my field trip to Lizard Island. I’ve been going there for 30 years.”

Marshall was treading water at ground zero of a global coral bleaching event – only the third ever recorded and the worst by far, all since 1998. To evoke the scene, he guides me on an imaginary walk through the loveliest forest I can conjure. But all the trees have lost their leaves. They are dying or dead and will soon start to fall down. The grasses and flowers are gone. The birds have flown away. Animals desperately search for food.

Marshall’s submerged Eden is Lizard Island’s Loomis Reef, 270 kilometres north of Cairns on the Great Barrier Reef.
Reef. Stretching 2300 kilometres up the coast from Bundaberg to the Torres Strait, the Great Barrier Reef is the largest living structure on the planet, a World Heritage site cherished for its biological diversity.

But Loomis was now a slagheap. Its annihilation had been so swift that the scientist reckoned even the fish, many of them searching out their vanished food gardens, looked traumatised.

"We were diving in dissolving reef," Marshall says. "The water had this terrible green ghostly quality - it was like diving in ectoplasm. It was awful. And essentially it was dying coral."

Aerial surveys in April confirmed 93% of the Great Barrier Reef had been hit by the bleaching to some extent. The northern section, which because of its remoteness had endured as the most pristine, copped it the worst. Last year, this area of the Reef was credited with saving Australia the indignity of its World Heritage treasure being declared by UNESCO as "in danger".

"Australia argued to UNESCO that the outstanding universal value of the World Heritage area is intact because we have this northern 30% of the Reef where everything is hunky dory," says Professor Terry Hughes, director of the ARC Centre of Excellence for Coral Reef Studies. "That is no longer the case. In the space of a month or two, the northern third is now more degraded than the southern two thirds."

In early May, as Canberra waited for the bell to ring on the federal election campaign, the Great Barrier Reef Marine Park Authority (GBRMPA) chairman, Dr Russell Reichelt, broke the news to a distracted Senate committee that more than half the coral in reefs in the far northern section were dead. He was unequivocal about where the blame lay. This was not the consequence of this summer's whopping El Niño, a natural warming cycle that occurs every five years or so. Bleaching was driven by "the upward trend in ocean temperatures, which is about 1 degree [Celsius] in the past century ... It is very strongly linked to global warming."

Scientists had been warning about this eventuality for decades. In 1999, Professor Ove Hoegh-Guldberg, one of Marshall's colleagues at the University of Queensland, spelled out the scenario. He plotted the future climate if humans continued to pump out greenhouse gases against the known tolerances of coral biology, and found a wipe-out. Events as shocking as the world's first mass coral bleaching event in 1998 "are likely to become commonplace within 20 years", he controversially concluded at the time.

"It's like seeing a picnic on a railroad," says Dr J E N "Charlie" Veron, Australia's most storied marine scientist, having discovered, named and catalogued around one quarter of the planet's coral. "And you're yelling out, 'Watch out, there's a train coming!' And the picnickers take no notice. The inevitability of it all is horrible."

Justin Marshall was shattered when he climbed out of the water at Loomis Reef. "My veil is down," he told the Guardian. "I have cried. I have broken down in front of cameras ... This is the most devastating, gut-wrenching fuck-up."

In a YouTube clip called Losing Nemo, Marshall shoots point blank. "Australia needs to decide. Do we want a reef, or do we want coal? Because we can't have both."

Terry Hughes, as leader of the 300-strong, multi-institutional National Coral Bleaching Taskforce, spent eight days flying low over 9000 kilometres of reefs, ranking them from not bleached through pale to white. Meanwhile, the taskforce also had 100 researchers underwater "eyeballing" corals on 150 reefs. In the far north of the Great Barrier Reef - from Cooktown up beyond the park limits towards Papua New Guinea - 80% to 90% of corals on many of the reefs examined were either dead or dying. While the final analysis of coral mortality will take some time, the northern Reef "will never look like it used to".

Hughes released the survey findings with a tweet that reverberated around the world: "I showed the results of aerial surveys of #bleaching on the #GreatBarrierReef to my students, And then we wept."

Such raw distress is more in the tone of first responders interviewed at a disaster scene than of sober scientific
commentary. This is controversial territory: at what point
does a scientist speaking passionately – notwithstanding
that the voice may be informed by decades of investigation
– forfeit the mantle of professional authority? And without it,
what are you? A mere activist? An “alarmist”?
“We’re telling it as it is,” says Hughes. “It’s a very serious
event – it’s hard to sugar-coat it.”
“I’m beyond monitoring a decaying environment,” Marshall
says. “People don’t realise, it’s not just the coral. We
lose the little fish and then the big fish … One quarter of all
marine life lives or goes through [reefs] at some point in its
life. It’s very frustrating for us little scientists pedalling away,
trying to get the message out that this is Australia’s biggest
ever environmental disaster.”
The Climate Council’s Will Steffen, emeritus profes­
sor at the Australian National University, argues it’s even
more than that. “The massive bleaching of the Great Bar­
er Reef, set in the context of extensive bleaching of coral
reefs around the world, is the most powerful signal yet of
the impact of climate change on the natural world – the
biosphere – anywhere.”
Or in the unadorned plain speak that scientists are start­
ing to use to get the message across: shit just got real.

My first encounter with coral was far from the tropics,
in country Victoria. It was not in a magazine or on
television, though Cousteau bobbed up there often
enough. I had the real deal, a long-deceased, pastel-painted
fragment interred in a perspex box labelled “Souvenir of the
Great Barrier Reef”.

As a kid, I loved handling this relic, touching its bubbly,
brITTLE arms, trying to magic some life into them. On turn­ing 18, within days of getting my driver’s licence, I navigated
across Melbourne to a scuba school to get my diver’s ticket,
en route to the dream of exploring the Great Barrier Reef.
And I did, many times, and now here I am again.

As waves of grim data on the bleaching wash in, a
schooner named Providence sails out of the pumping Whitsun­
days hub of Airlie Beach, a town perennially crowded with
toasted 20- and 30-something Europeans on their rite-of-
passage trip along the Queensland coast. We drop anchor in
Blue Pearl Bay, Hayman Island, which I last saw 17 years ago.

I gingerly wade through the rubble tide of old coral
bones into the too-warm water until I find enough depth
to get my head under. Terry Hughes’ surveys advised that
this section of the Reef has suffered only moderate bleach­
ing. I’m relieved to hear excited squeals trumpeting out of
the snorkels of a pair of young British tourists. Glory be, it’s
still down there.

Mike and Sophie are blown away. Snorkeling off Cairns
a week earlier, they’d been disappointed by patchy, pallid
reef and not so many fish. Blue Pearl Bay is teeming with life,
but it seems more anaemic than I recall.

Blow-ins like us can’t see what is not there. A 2012 study
by the Australian Institute of Marine Science found that the Reef as a whole
had lost more than 50% of its initial coral cover since 1985, nearly all of it
in this central zone and further south. The two major culprits were tropical
cyclones and the voracious predatory
crown-of-thorns starfish that chew up
the reef and thrive in the mucky condi­
tions created by human contaminants.

We’re lucky to have a day with
reasonable visibility. Declining water
quality, mostly caused by dredging
and run-off from agriculture, has until
now been the paramount immediate
threat. Such chronic ailments become
all the more worrying in the context
of bleaching because they diminish a
reef’s capacity to recover.

Last year the cost for tackling the
water quality issues due to river pol­
lution alone was calculated at $785
million in new funding over the next
five years, and then another $1 billion

A yellow clown goby (Gobiodon kokinawae) in bleached acropora coral. Image courtesy of CoralWatch, coralwatch.org
beyond that. Environment Minister Greg Hunt boasts that the Australian and Queensland governments are committed to spending $2 billion on Reef health in the next decade, but according to water experts the figure needs to be bumped up by multiples of that.

“They say they are spending $2 billion, and it sounds impressive,” says Jon Day, a reef-management expert who has been a GBRMPA director and a World Heritage Committee delegate. “But that figure includes the budgets for the Australian Maritime Safety Authority and the Department of Natural Resources and Mines – most of that is not just for the Reef. So $200 million a year over ten years is nothing more than business as usual. And the key point is, it is not fixing the problem – the values are still declining.”

On top of all this comes global warming, which sums in our 2016 climate report. Without important changes in land use, the future isn’t looking good.

The northern section succumbed to this season’s too-warm tide. But further south, through mid March, likely there are deal-breakers. One of them is too-warm water, prompt to 34°C, and stayed above average until the end of March. The mean monthly maximum of Q9°C, with fluctuations up by multiples of that.

Hughes says. “Obviously the fish that eat corals – like butterfly fish – disappear. Many small-bodied fish live exclusively in the corals, some with a single species of coral, so if those decline so do the fish.” Big, commercially important species like coral trout also need the nooks and crannies of reefs through their juvenile years. These species and others can live for decades,

As enduring as this relationship has been over the eons, there are deal-breakers. One of them is too-warm water, prompting stressed-out corals to spit out their resident algal communities. In the process they turn white, hence “bleaching”. From the start of this year the sea surface temperature in the Great Barrier Reef’s northern section kicked up above the mean monthly maximum of 29°C, with fluctuations up to 34°C, and stayed above average until the end of March.

“When I was a student, no one had ever heard of coral bleaching except at a very local scale,” recalls Terry Hughes. “The notion of hundreds and now thousands of kilometres of coastline turning white is an entirely modern phenomenon.”

The first regional-scale bleaching events were recorded in the eastern Pacific in the mid ’80s, and in the Caribbean by the late ’80s. El Niños came and went long before scientists had identified and named them, but there had been no mass bleachings on the Great Barrier Reef before 1998. Then it happened again in 2002 – not an El Niño year. “It was just bloody hot,” says Hughes. “So we’ve entered an era where bleaching is recurring due to global warming.”

Bleached corals can recover, albeit slowly, if conditions cool off swiftly enough to allow the zooxanthellae to regroup and move back in. This assumes that there are surviving populations close by, and that there is reasonable overall reef health. If this isn’t the case the corals die, with profound implications for the marine ecosystem.

While diving at Blue Pearl Bay I spot plenty of luminous parrot fish pecking furtively at the coral heads. Further north, where the Reef has been so whacked, their kind will likely be winners as algae – their fodder – claim the coral carcass. But what of the other fish species?

Schools of angelfish and butterfly fish swirl so close I’m surprised not to gather up dozens as I swim through. Behind them come swarms of blue damselfish, and beneath, a flashy cameo from a clownfish, Hollywood’s Nemo. His northern cousins have found sad new fame in Justin Marshall’s YouTube footage, standing out against the bleached snow-white tentacles of anemones.

On a heavily bleached reef “the fish assemblage changes”, Hughes says. “Obviously the fish that eat corals – like butterfly fish – disappear. Many small-bodied fish live exclusively in the corals, some with a single species of coral, so if those decline so do the fish.” Big, commercially important species like coral trout also need the nooks and crannies of reefs through their juvenile years. These species and others can live for decades, so “you might not notice an impact immediately on the adult fish ... but sooner or later the stocks will disappear because they are not being replenished. That is well documented.”

Justin Marshall says he and his students are already observing fish losses around the reefs in the northern section. “I’m watching fish starve. My students can no longer find the fish they are after ... All the coralliferous fish are clustering around the remaining corals that are left for them, and the fish that rely on the shelter of the reef have none.”

This kind of commentary infuriates some tourist operators, who fear it will scare off the punters. There are reports of them bumping media and “greenies” off their vessels. And certainly the complex story has been confused by some sloppy reporting – conflating bleaching and mortality, for instance – and some sly editing. Biased and limited coverage...
The issue by the Courier-Mail prompted 57 leading scientists with 1200 years of expertise between them to sign an open letter – paid for by the Climate Council and published in the newspaper as a full-page advertisement – spelling out the scale of the crisis, the cause (fossil-fuel burning) and the solution (“We must phase out coal”).

“I recently had an experience with 30 or 40 [Coalition] backbenchers who don’t believe in climate change and throw up any excuse”

A sign outside the busy Proserpine airport, 20 minutes from Airlie Beach, boasts it is the “Gateway to the Whitsundays and Coalfields”. Someone once said to me that God, or Gaia, or whoever you believe in must have been having a right old joke with us when they put one of the world’s largest coal deposits just inland from the Reef,” says Louise Matthiesson, long-time Reef campaigner with the World Wildlife Fund.

While Airlie tourism has largely dodged the bleaching bullet this time, the issue has put the relationship between the two industries at flashpoint, and there’s momentum on the tourism side to start exercising some of its not-insubstantial muscle and shape up against the resources behemoth.

The community includes activists who earned their stripes during the successful battle to ban the dumping of dredge spoil from new industrial ports on the Reef. Last month, one of the activists, Providence Sailing co-owner Lindsay Simpson, authorised publication of an open letter to the prime minister signed by 84 tourism operators – “stewards of the Great Barrier Reef” – calling for an urgent shift away from coal and into renewables.

Simpson and her husband, Grant Lewis, moved their operation down to the Whitsundays from Magnetic Island last year because the reef they had been taking tourists to visit had become so degraded. “We were apologising to people before they got in the water: ‘What you are going to see isn’t what you imagine.’ We took ‘magnificent fringing reef’ off the brochures.”

The couple’s passion for the Reef and concern for its future are shared by the vast majority of tourism operators, says the Queensland Tourism Industry Council’s Daniel Gschwind. “They are not just there to make a buck. They have a deep, almost spiritual, connection to the places they visit and take their visitors to, and that’s not hyperbole. So their interest is very much also in conservation, in looking after what they sell.”

The Great Barrier Reef attracts more than two million visitors each year, generates almost $6 billion for the Queensland economy, and supports 69,000 jobs. Gschwind says that at the moment the tourism industry is going strong. But the future is worrying. “It’s hard to see how the further development or expansion of the coal industry can support or in any way contribute positively to the future of the Reef... There is no denying that the further extraction and burn-

A now of course the most significant and long-term but least tractable threat to the preservation of the Great Barrier Reef is not from illegal fishing or polluted run-off from agriculture or from bulk carriers that run aground and leak bulk bunker fuel, but from a much broader collision between human economic activity and the natural environment – global warming, caused in large part by our burning of fossil fuels and the clearing of land and the felling of forests.”

The speaker is Malcolm Turnbull, then shadow minister for communications, who in July 2011 used the occasion of the inaugural Virginia Chadwick Memorial Lecture to mount a guns-blazing defence of the Great Barrier Reef and of the then besieged climate-change science.

Chadwick, who died in 2009, was a NSW Liberal
politician, former chair of the GBRMPA and a “strong friend of the environment”. In Turnbull’s speech, he raged against the “war on science and scientists”, told cautionary tales about some of his (unnamed) friends being seduced by far-right anti-science propagandists, and appealed to his largely Liberal audience to recognise respect for science as conservatism. “If Margaret Thatcher took climate change seriously and believed we should take action to reduce global greenhouse emissions, then taking action and supporting and accepting the science can hardly be the mark of insipient Bolshevism,” he said.

“The consequences of getting our response to climate change wrong will not likely be felt too severely by us, or at least not by most of us, but will be felt painfully and cruelly by the generations ahead of us. And the people in the world who will suffer the most cruelly will be the poorest and the people who have contributed the least to the problem. There is an enormous injustice here. When people suggest to you that climate change is not a moral issue, they are wrong. It is an intensely moral issue.”

Turnbull, who was speaking 18 months after being dropped as Opposition leader over his decision to support the Rudd government’s carbon pricing scheme, urged Australia’s participation in the transition to zero or near zero emissions by mid century.

Five years later, as the dire evidence of bleaching on the Reef washed in, the Turnbull government’s pre-election budget maintained more than $7.7 billion per year in subsidies to fossil fuels, while spending virtually nothing on climate-change mitigation. A $171 million “boost” trumpeted by the ferocious El Niño drought. All they have now are the fish that are sold in the marketplace. The Torres Strait has been hit with severe bleaching across 100% of its reefs. Shit got real for them some time ago.

“If you look across the world at tropical regions, there is a dependency on coral reefs for food and livelihoods that probably extends to around 500 million people,” says Hoegh-Guldberg. “And these are people who might operate small-scale fisheries, or might be involved in tourism, or might just be going out onto the reef crest to glean seafood to bring back to their families. So there is this huge number of people in Indonesia, the Philippines, PNG, Solomon Islands, etc. who are really dependent on coral reefs being healthy.

“This is the sort of thing that needs to be on Australia’s radar. It’s not just about pretty reefs disappearing. It’s got geo-security issues. We are seeing the climate having a much greater impact than even the scientists thought.”

In mid March, as water temperatures spiked over the Great Barrier Reef’s northern section, Charlie Veron and Airlie Beach tourism activist Lindsay Simpson went to Canberra with Imogen Zethoven of the Australian Marine Conservation Society to lobby for an urgent shift towards renewables and away from coal, to help save the Reef. In their sights was the federal and Queensland governments’ approval of the Adani coalmine – “the very opposite of what [we] should be doing”, Veron says.

Veron didn’t get to see the prime minister, or the environment minister, but he did spend what he thought was a very engaged hour with Hunt’s adviser. Soon after, as the bleaching hit the headlines, Veron appeared on the ABC, deploring the lack of political action. Soon after, “Greg Hunt phoned me and asked – in a tone of voice that implied fault on my part – if I had been to Canberra to discuss my concerns. He wasn’t even aware we had been there. It’s just hopeless.”

And so Veron has returned to the task that has occupied him for much of the past decade, and into which he retreats every time frustration and fatalism overcome his energy and evangelism for the Great Barrier Reef. He is collating 50 years of underwater work into an online open-source catalogue with detailed scientific descriptions and images of every coral on the planet. It’s a mammoth exercise, one that began as a tribute to the living world but which he fears will now endure as a memorial to lost species. At the 13th International Coral Reef Symposium in Hawaii this month, which promises to be a grim affair, Veron will launch his epic Corals of the World website. A virtual reef for the foreseeable future.