

From Polyp to Rampart, The Science of reef building and how art can inspire a sustainable future

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There are many ways to contemplate a coral reef. You might peer through an airplane window and see a coastline with a bright turquoise margin trimmed in white surf. You might spot the giant ring of an atoll clinging to the sides of an undersea volcano. Seen from above, it becomes fathomable that coral reefs house riotous forms of life, protect land's edge from battering storms, and feed millions of people.

Get much closer to a coral reef – look at it through a microscope – and you'll see a whole other world reveal itself. Each colony of reef-building coral is itself built from thousands of polyps that look like miniature pulsating flowers, peeping out of perforations in a skeleton sculpted from bone-white calcium carbonate. Inside each polyp are millions of cells, clustered like tiny marbles. These zooxanthellae, nicknamed 'zoox', give corals their bright colors and make life possible in parts of the ocean where nutrients are in short supply. They harness the sun's energy to create sugars, some of which leak out into the coral polyp. And in return for this free meal, the zoox get a safe, sunny home.

Many people nowadays have the means to see coral reefs for themselves, a snorkel tube in their mouth or blowing noisy bubbles from a scuba tank. From this point of view, captured increasingly in film and photographs, reef ecosystems flaunt their astonishing diversity of living things. When photographer David Liittschwager recently placed a one-cubic-foot metal frame onto a reef near Tahiti and watched it for 24 hours, he saw 600 species living inside or swimming, crawling and ambling through the small space. Coral reefs cover less than one percent of the oceans and but are thought to be home to a quarter or even a third of all marine species. Brimming with so much life, coral reefs put on one of the most colorful and dynamic spectacles of the natural world.

How exactly so much life piles up in such a small portion of the ocean remains a tantalizing puzzle. Studies are beginning to reveal how much [even](#) more life lies hidden inside a reef. The so-called cryptofauna includes worms and shells that drill into the reef structure and sponges that filter water as it percolates through honeycomb crevices. Scientists around the globe are working hard to discover all the species that live on reefs and to figure out how these complex ecosystems fit together.

Reefs are at risk

Coral reefs face numerous problems today that play out at these same scales at which we observe them. Looking down from an airplane, you can see the wide seascape across which climate change inflicts a three-pronged attack. The seas have become thirty per cent more acidic since the industrial revolution because they absorb a lot of the carbon dioxide human activities emit. Scientists estimate that by 2050 the oceans could be so acidic that only fifteen per cent of the world's reefs will be able to keep growing; everywhere else their carbonate skeletons will simply begin to dissolve away. With rising temperatures come rising sea levels as waters thermally expand and ice sheets and glaciers melt. As this process continues and with growth rates compromised by corrosive waters, fewer reefs will be able to keep pace and maintain their position in sunlit shallows. A third climate impact takes place on reefs at a microscopic level because if there's one thing zooxanthellae can't stand, it's warm water. When the temperature goes up by just a few degrees for a couple of months, zoox abandon their coral host, leaving behind a ghostly white skeleton. There's a chance the coral colony might survive a few weeks of bleaching and eventually take on board replacement sugar-producing lodgers. Usually they die. Mass coral bleaching events have swept

across entire regions with increasing frequency and severity as sea temperatures have risen since the early 1980s. Warmer seas also seem to make corals more vulnerable to lethal diseases, which are already devastating reefs. The situation will only get worse.

Other threats to reefs take place at an ecosystems level. One of the most critical is overfishing. When entire groups of fish are stripped away they are sorely missed not just by visiting divers and snorkelers but also by the ecosystem. Their absence often triggers complex and unpredictable cascades of change through a reef. Without large parrotfish to clear away dead coral and sediment, areas of reef can become smothered and inhospitable for new corals. Grazing fishes nibble down fleshy algae that outcompete reef-building corals – and some even respond instantly to chemical burglar alarms released by corals when algae touch them. Trawl nets, fish bombs and cyanide pose additional threats to reefs and despite being widely banned still rip up, blow apart, and poison reefs.

All of these problems, plus many more, add up to the chilling reality that most of the world's coral reefs are already at risk. Findings from the Reefs at Risk Revisited study in 2011 revealed that seventy five per cent of all coral reefs are now threatened by human activities. Looking into the future, that number is likely to go up starkly to eighty percent by 2030 and by 2050, if the world carries on with business as usual, ninety-nine per cent of coral reefs will be threatened.....*cont. To read the fully essay please obtain:*

The Underwater Museum, The submerged sculptures by Jason deCaires Taylor

