NEWS IN FOCUS

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DAVID DOUBILET/NGS

The health of coral reefs is normally assessed by scuba surveys and other close-up views.

OCEANS

Reefs mapped from above

Satellites and research aeroplanes could offer a better, broader view of coral health.

BY ALEXANDRA WITZE

Eric Hochberg has studied coral reefs for two decades, but the marine ecologist is about to see them in a fresh light. Beginning on 6 June, Hochberg and his colleagues will use a specially outfitted NASA aeroplane to map the spectra of sunlight reflecting off reefs spread across the Pacific Ocean far below. The scientists aim to tease out the spectral signatures of coral, algae and sand — and to check the health of the reefs.

The three-year, US$15-million Coral Reef Airborne Laboratory (CORAL) project will be the biggest and most detailed study yet of entire reefs, rather than just the small patches that scuba divers can reach. CORAL is part of a growing push to map reefs faster, and in more detail, than ever before. Marine scientists are putting new instruments onto planes, satellites and even drones to gain a broader perspective on how well corals are doing — or not.

After its surveys in Hawaii, Australia's Great Barrier Reef, the Mariana Islands and Palau (see 'Under the sea'), CORAL will have mapped about 3–4% of the world's reef area, hundreds of times more than previous scuba surveys.

Warming ocean waters have led to massive coral-bleaching events such as the one now devastating the Great Barrier Reef. The CORAL scientists hope to learn how individual reefs respond to such threats. "We want to start looking at things at the ecosystem scale, which is really hard to do in the water," says Hochberg, at the Bermuda Institute of Ocean Sciences in St George's.

Remote sensing of coral reefs is hard because the oceans reflect so much less light than the land, says Heidi Dierssen, a marine ecologist at the University of Connecticut Avery Point in Groton, who is part of the CORAL team. And scientists have to do elaborate calculations to correct for the distortion of light on its journey through the atmosphere and through water — a bright, deep ocean bottom and a dark, shallow bottom can both look the same to a remote-sensing camera.

Teasing out such distinctions requires scanning an area using as many wavelength bands as possible. "When you have the full spectrum, you can say so much more about what is there," Dierssen says.

One of the latest views from above comes from the Sentinel-2 satellite, launched by the ▶

▶ European Space Agency in June 2015. Although the satellite was not designed to study reefs, it has relatively sharp vision and can operate over more and narrower spectral bands than the US Geological Survey's Landsat-8 satellite, another workhorse of Earth observing. And unlike data from keen-eyed commercial satellites, Sentinel's observations are free to use.

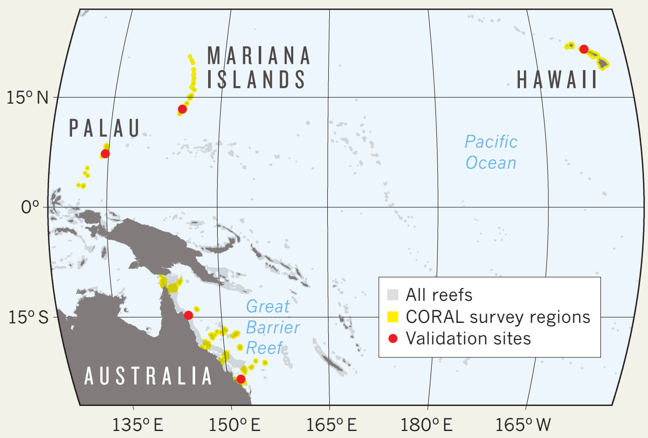
Sentinel-2 will also eventually revisit the same spot every 5 days, compared with Landsat-8's 16-day return period. That makes it a better choice for studying short-term marine phenomena such as coral bleaching and algal blooms, says John Hedley, a remote-sensing expert at Environmental Computer Science in Tiverton, UK, who is on the science team for the Sentinel-2 coral study, Sen2Coral.

Team members are set to report early results on mapping reef bottoms at a coral-reef symposium in Honolulu, Hawaii, on 22 June.

But in the wavelength range applicable to underwater sensing — 430–710 nanometres — Sentinel-2 cannot capture details that CORAL's plane can. The plane carries an instrument that gathers data in more than 100 narrow spectral bands in that range, including the signature of photosynthetic organisms within the living coral itself at 570–575 nanometres.

UNDER THE SEA

Over the next three years, a NASA research aeroplane will survey coral reefs throughout the Pacific Ocean — including the rich ecosystems of the Great Barrier Reef in Australia.



SOURCE: ERIC HOCHBERG

CORAL will focus on one simple metric: how much coral cover there is on a given reef, as opposed to algae and sand. From that, researchers can calculate how well the coral is doing at transforming sunlight into energy to maintain a reef structure. Hochberg and his colleagues hope to use that information to better understand how local changes, such as an increase in pollution, might affect coral's health.

The June flights in Hawaii will test whether all the equipment is working. From there, the Gulfstream IV plane will go to the Great Barrier Reef in September and October, followed by Hawaii, the Mariana Islands and Palau in 2017. Divers will simultaneously measure the optical properties of the surrounding seawater and the reef condition up close, to cross-check what the plane sees from 8,500 metres above.

The flights will provide a snapshot of some of the world's most important reefs, says Serge Andréfouët, a marine ecologist at the Research Institute for Development (IRD) in Nouméa, New Caledonia, who led an earlier coral-mapping effort with the Landsat-7 satellite.

But CORAL will be a one-time glimpse only. With limited funding, there are no plans to repeat any flights to see how the reefs change over time, Hochberg says.

Instead, the team hopes to provide a rich set of baseline data for future coral studies. "You have to pick and choose where you go to try to understand how the ecosystem is working," he says. ■

PUBLISHING

Biology's big funders boost *eLife*

Open-access journal nets £25 million in support until 2022.

BY EWEN CALLAWAY

When three of the world's biggest private biomedical funders launched the journal *eLife* in 2012, they wanted to shake up the way in which scientists published their top papers. The new journal would be unashamedly elitist, competing with biology's traditional 'big three', *Nature*, *Science* and *Cell*, to publish the best work. But unlike these, *eLife* would use working scientists as editors, and it would be open access. And with backers providing £18 million (US$26 million) over five years, authors wouldn't need to pay anything to publish there.

Four years and more than 1,800 publications later, *eLife*'s funders — the Howard Hughes Medical Institute in Chevy Chase, Maryland, the Wellcome Trust in London and the Max Planck Society in Berlin — announced on 1 June that they will continue their support. They will back the non-profit *eLife* organization with a further £25 million between 2017 and 2022 (see '*eLife* by the numbers').

"*eLife*'s status in the field is rising quite quickly," says Sjors Scheres, a structural biologist at the Laboratory of Molecular Biology in Cambridge, UK. He became an editor at the journal in 2014, overseeing papers on electron microscopy. "I liked the idea behind it — to make a high-impact journal completely driven by scientists, and open," he says. Although scientists like publishing in the journal, it's less clear whether it has catalysed a wider transformation at the elite end of science publishing.

COLLABORATIVE ATTRACTION

The journal's most innovative feature, according to its authors and reviewers, is its collaborative peer-review process. It turns conventional peer review — in which referees submit individual, and sometimes contradictory, reports — on its head. Instead, referees and scientist–editors work together to identify a submitted paper's strengths and weaknesses and any needed revisions. Authors receive one decision letter, not individual reports from each referee.

That makes for a speedy review: last year, *eLife*'s published papers took, on average, 116 days from submission to acceptance. For comparison, *Nature* and *Cell* take around 150 days, although *Science* says that in 2013 it took 99 days from submission to acceptance. *Cell* and two of its sister journals have experimented with a similar peer-review model but none has yet adopted it. Peter Binfield, the publisher of another open-access journal, *PeerJ*, in San Francisco, California, says that he likes *eLife*'s peer-review system, but he thinks that the approach would be impossible to scale up to adopt for all published articles.

SELECTIVE BUT OPEN

As it bids to become a top journal, *eLife* has started to turn down more of its submissions. The journal's acceptance rate dropped from