With Advanced Tech, Expedition Reveals New Hope for World’s Coral Reefs

Scientists equipped with 360-degree cameras on underwater scooters and advanced AI image recognition are finding coral safe havens.

(An extensive gallery of photographs and videos from the expedition is available free for media use.)

MANADO, Indonesia — Scientists using artificial intelligence and underwater scooters to assess reef health after global warming sparked bleaching that killed a very large number of the planet’s shallow-water corals have found surprisingly healthy reefs off Indonesia.

Marine scientists from The University of Queensland in Australia produced and analyzed more than 56,000 images in an area known as the Coral Triangle around the island of Sulawesi during a six-week expedition.

Using underwater scooters fitted with 360-degree cameras allowed researchers to photograph up to 2 km/1.5 miles in single dives. Then artificial intelligence analyzed those images much faster than human scientists could.

The expedition, funded by Paul G. Allen Philanthropies, aimed to evaluate how global-warming-induced coral bleaching between 2014 and 2017 had affected the Coral Triangle.
Researchers found that reefs that had experienced little impact had bounced back or were in better shape than when they were originally surveyed in 2014. The findings can help plan how best to target coral restoration programs elsewhere.

"After several depressing years as a coral reef scientist, witnessing the worst-ever global coral bleaching event, it is unbelievably encouraging to experience reefs such as these," said Dr. Emma Kennedy, the British scientist who led the team of researchers from the U.K., U.S., Australia, Indonesia and Trinidad.

“It means we still have time to save some coral reefs through the science-based targeting of conservation action.”

Coral reefs support roughly a quarter of all ocean life and provide over 500 million people with food and income, contributing about $375 billion annually to the global economy.

They are extremely vulnerable to temperature changes because oceans’ upper layers absorb more than 90 percent of the heat generated by carbon emissions, which has devastated reefs.

At the current rate at which CO₂ is accumulating in the atmosphere, most coral reefs are not predicted to survive past 2050.

"Paul Allen believes that through data, technology and science, we can solve some of the world’s most intractable challenges," said Art Min, vice president for impact with Paul G. Allen Philanthropies. "The data gleaned from this survey will help us better understand coral resiliency and inform critical conservation efforts. It’s a sign of hope for coral reefs and the ecosystems that depend on them."

If reefs that are less vulnerable can be protected from other stresses, such as plastic pollution and overfishing, until ocean temperatures stabilize, they could rapidly replenish surrounding reefs that have been more affected by climate change in a domino-like effect.

The future of coral reefs depends on finding reefs “that are most likely to survive until global warming is brought under control,” said Professor Ove Hoegh-Guldberg, a University of Queensland professor and chief scientist of the initiative.

“Technology is now allowing us to do just this,” he said. “It is very exciting.”

In a related project, the expedition team has been using the latest satellite data and climate-change predictions to map vulnerability across the planet, identifying areas where coral reefs may be less exposed to heat stress and storms.
Scientists are limited by how long they can physically stay underwater, and photography has already helped by giving them the time to analyze images of reefs back at the lab. Now, AI image recognition is accelerating the painstakingly slow process of identifying and cataloging coral reef data.

"The use of AI to rapidly analyze photographs of coral has vastly improved the efficiency of what we do — what would take a coral reef scientist 10 to 15 minutes now takes the machine a few seconds," Dr. Kennedy said. "It means we can start scaling up from studying reefs at the meter scale to looking at patterns of coral communities at the kilometer scale."

The recognition software uses a form of Deep Learning AI to detect patterns in large amount of data. It uses algorithms and its own judgment after a period of "supervised learning," in which scientists show it how to recognize corals, groups of algae and other invertebrates from increasingly complex contours and textures.

"The machine learns in a similar way to a human brain, weighing up lots of minute decisions about what it's looking at until it builds up a picture and is confident about making an identification," Dr. Kennedy said.

The program is usually able to perform well after it has been shown between 400 and 600 photos. Then the learning stops and it can process images on its own.

The software is being used to assess more than 56,000 images taken during the expedition, which ended in June, comparing them to images taken of the same reefs during the 2014 Coral Triangle survey that was part of the XL Catlin Seaview Survey led by The Ocean Agency and The University of Queensland.

Initial observations show that there appears to be little to no deterioration of the corals in the 3,851-square-kilometer (1,487-square-mile) assessment area.

The team is also starting to use cloud-based analysis to auto-generate comparison reports, dramatically reducing the cost of monitoring while expanding the scale at which measurements can be made. Full reviewed results from the science team are expected later this year.

The expedition program was conducted during the International Year of the Reef 2018, declared by the International Coral Reef Initiative in collaboration with UN Environment and supported by The Tiffany & Co. Foundation.

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IMAGES, FILM, ONLINE

Journalists and editors should use the following credentials to access, download and use for free all of these materials: www.coralreefimagebank.org/coral-triangle-resurvey

A variety of images and video is available for use, including:
- High-definition b-roll video
- 360-degree Facebook-ready images
- 60-second and 2.5-minute edited, broadcast-ready videos, including scripts
- Captioned high-resolution photographs of the expedition
- Q&As with Dr. Emma Kennedy and Tri Aryono Hadi, one of the Indonesian scientists on the expedition

ABOUT PAUL G. ALLEN PHILANTHROPIES

Paul G. Allen Philanthropies is a key part of Microsoft co-founder and philanthropist Paul G. Allen's commitment to improving our planet through catalytic philanthropy, inspirational experiences, and scientific and technological breakthroughs. Empowered by Paul's vision to create a better world, we take an unconventional approach to tackling hard problems by integrating technology, data, policy, and powerful storytelling to drive positive change in our community and around the globe.

ABOUT UNIVERSITY OF QUEENSLAND

Global Change Institute, University of Queensland advances discovery, develops solutions and advocates responses that meet the challenges presented by climate change, technological innovation and population change. It has partnered with The Ocean Agency on a number of projects including the XL Catlin Seaview Survey which established the world’s first global baseline for coral reef health in 22 countries using semi-autonomous technologies and computer learning. UQ is one of the world’s premier teaching and research institutions. It is consistently ranked in the top 100 in four independent global rankings. With more than 48,000 students and 6,500 staff, UQ’s teaching is informed by research, and spans six faculties and eight research institutes.

ABOUT THE OCEAN AGENCY

The Ocean Agency is nonprofit dedicated to supporting ocean science and conservation through creative communication and technology innovation, providing media with stories and imagery to help raise awareness of ocean issues. The Ocean Agency developed the concept and cameras for the XL Catlin Seaview Survey, which has become the most comprehensive visual survey of coral reefs ever conducted, carried out in partnership with the University of Queensland.
ABOUT INTERNATIONAL YEAR OF THE REEF

International Coral Reef Initiative has declared 2018 the third International Year of the Reef (IYOR). This year-long celebration is a great opportunity to come together to raise and strengthen awareness on the plight of coral reefs, and to step up and initiate conservation efforts.

BACKGROUNDER FACTBOX

- The previous coral survey in Manado took place in 2014.
- The Coral Triangle is a 5.7 million-square-kilometer (almost 4 million-square-mile) area of the western Pacific Ocean that includes Indonesia, Malaysia, the Philippines, Papua New Guinea, Timor Leste and the Solomon Islands. It is called the “Coral Triangle” because of the substantial number of coral species found in the region.
- Researchers on this expedition included:
  - Professor Ove Hoegh-Guldberg, Director of the University of Queensland’s Global Change Institute, from Australia
  - Dr. Emma Kennedy, University of Queensland lead scientist, from the UK
  - Dr. Anjani Ganase, University of Queensland field scientist, from Trinidad
  - Kathryn Markey, University of Queensland field scientist and technical officer, from Australia
  - Dominic Bryant, University of Queensland field scientist, from Australia
  - Patrick Gartrell, University of Queensland field scientist, from Australia
  - Tri Aryono Hadi, Indonesian Institute of Sciences scientist, from Indonesia
  - Dr. Andreas Roeroe, Sam Ratulangi University scientist, from Indonesia
  - Richard Veyvers, founder and CEO of The Ocean Agency, from the UK
  - Stephanie Tate, The Ocean Agency senior program manager, from the US
  - Stefan Andrews, The Ocean Agency expedition videographer, from Australia
- The Ocean Agency expedition series aims to highlight positive reef stories from around the world.
  - It is being conducted as part of International Year of the Reef 2018, declared by the International Coral Reef Initiative (ICRI) in collaboration with the UN Environment and supported by The Tiffany & Co. Foundation
  - You can follow the expedition series by following The Ocean Agency on social media, or by checking the Coral Reef Image Bank, where expedition stories and media assets will be hosted, or signing up to receive updates.