Q&A

Question-and-Answer with Dr. Emma Kennedy
Postdoctoral research fellow at the University of Queensland and lead scientist of the Coral Triangle Resurvey

1. What is it about these reefs in the Coral Triangle that makes them less vulnerable to climate change?

It’s all about location! Not all of the planet is exposed to climate change in the same way – some reef areas haven’t experienced as much warming as others, and some are predicted to warm less in future. Our recent study used the very latest satellite data and climate-change predictions to map vulnerability across the planet and identify areas where coral reefs may be less exposed to heat stress and storms. We believe that oceanographic factors in the Coral Triangle have kept the reefs cooler and protected them from the recent bleaching event.

2. What were you predicting the results of the resurvey would show? Have the actual results proved differently than you thought?

Satellite data from 2016/2017 indicated that North Sulawesi hadn’t warmed much during the global bleaching event, so we were hopeful the reefs had escaped damage. It was still a nice surprise to see such vibrant corals, and our colleagues in Indonesia were able to confirm that the area didn’t bleach. What was shocking was the amount of damage from local sources — particularly plastic trash and destructive fishing that was still going on, even inside the Bunaken National Marine Park. We’re still analyzing the data — it will take us about four weeks to prepare the 56,648 images for the machine to process, and then a day for the machine to extract the data. But it will be interesting to see how the sites have changed between 2014 and 2018. Given that this area might be an important climate refuge, it is imperative that local stressors are removed.

3. When do you predict ocean temperatures will stabilize?

Predictions for when the ocean will stop warming depend on the scenario modelled. If we continue to emit greenhouse gases at the current rate, the predictions say that ocean temperatures won’t stabilize anytime soon — in fact, they’ll continue to rise indefinitely, with potentially disastrous consequences! Under the very-best-case scenarios, if we make a concerted effort together to keep warming below 1.5 degrees, experts hope that ocean temperatures might stabilize around 2050. This is because the temperature of the ocean lags behind that of the atmosphere — just like how a kettle takes quite a while to warm up but then stays warm for longer. Even if we reduce CO2 emissions today, we’re still committed to a certain degree of future warming. We know that the upper layers of the ocean have absorbed 93 percent of excess heat from the greenhouse effect. While this is having devastating impacts on marine organisms like corals, by acting as a buffer, the ocean has protected us from the very worst global warming. The average earth temperature would be 36 degrees Celsius hotter if the ocean hadn’t absorbed all this heat, which would make life very uncomfortable!
4. How did you develop the idea to use artificial-intelligence technology on reefs? How has this technology helped the team in its research?

Coral-reef scientists have traditionally been limited in the amount of data they can collect — because of restrictions on how long the human body can stay underwater! Photography has helped us expand the reef area we can examine while we’re diving, but going through photos back in the lab is a slow and painstaking process. 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. 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. Getting a bigger picture of what’s going on can improve our capacity to understand and monitor reef health.

5. How does artificial-intelligence image recognition work? How long does the process take, start to finish? What does the finished product look like?

We use a type of machine learning called Deep Learning — an AI that is becoming popular in helping detect patterns in large amounts of data (in this case, images of coral reefs). Deep Learning depends on neural networks training: The machine learns in a similar way to a human brain, weighing lots of minute decisions about what it’s looking at until it builds up a picture and is confident about making an identification. Reef organisms grow in all different shapes, so we train deep neural networks to map image patches to key reef categories. We use “supervised learning” to teach the system how to identify corals, groups of algae and other invertebrates; once the deep neural network is able to perform well on its own (usually after we’ve shown it about 400 to 600 photos), the learning stops and it can process images on its own. The output is a spreadsheet that contains the proportion of different reef species detected in each photo. After a field trip like this, it will take around three to four weeks to complete the entire image analysis, however the image classification itself using the trained neural networks is only about 36 hours (per 50,000 images).

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