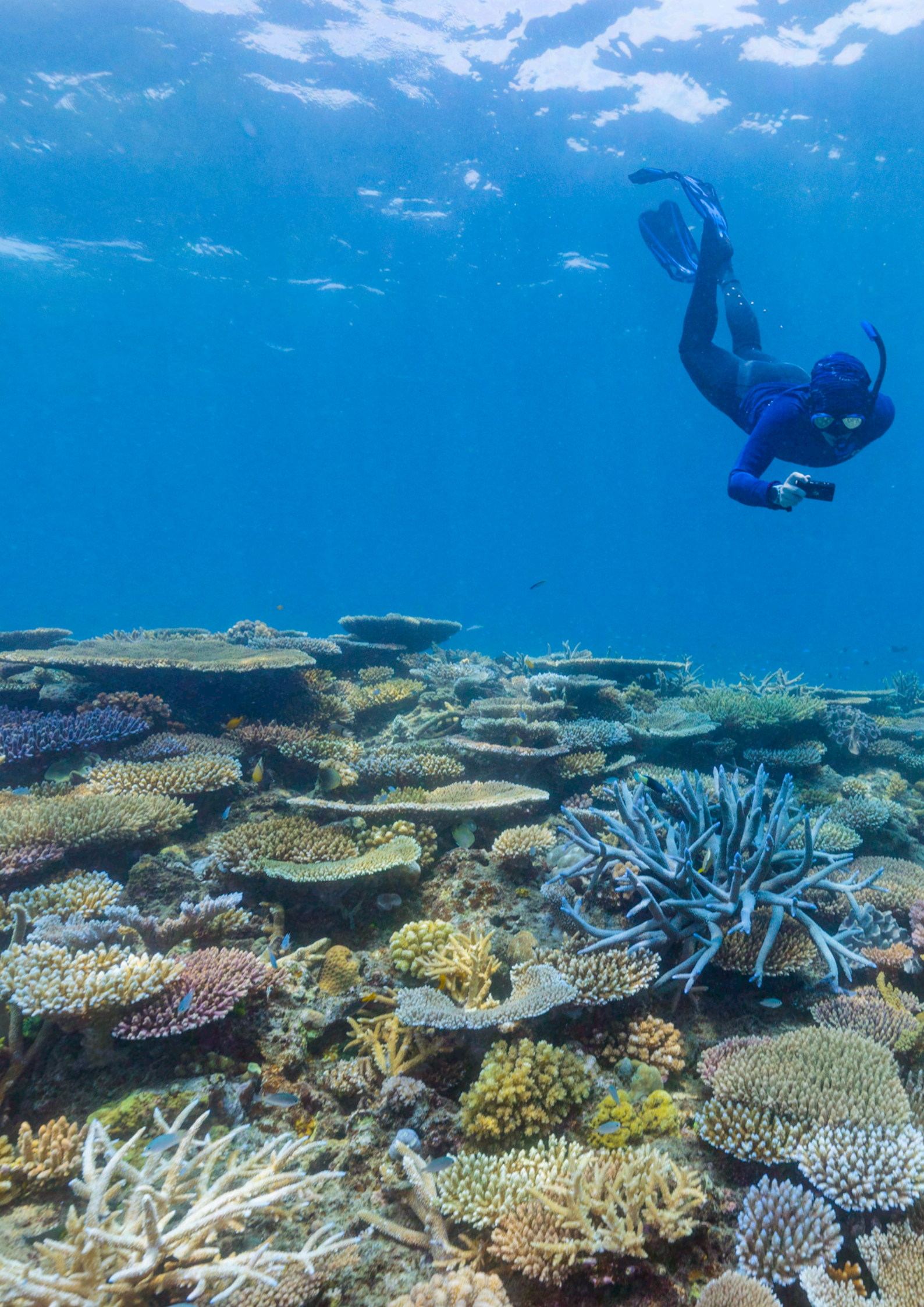
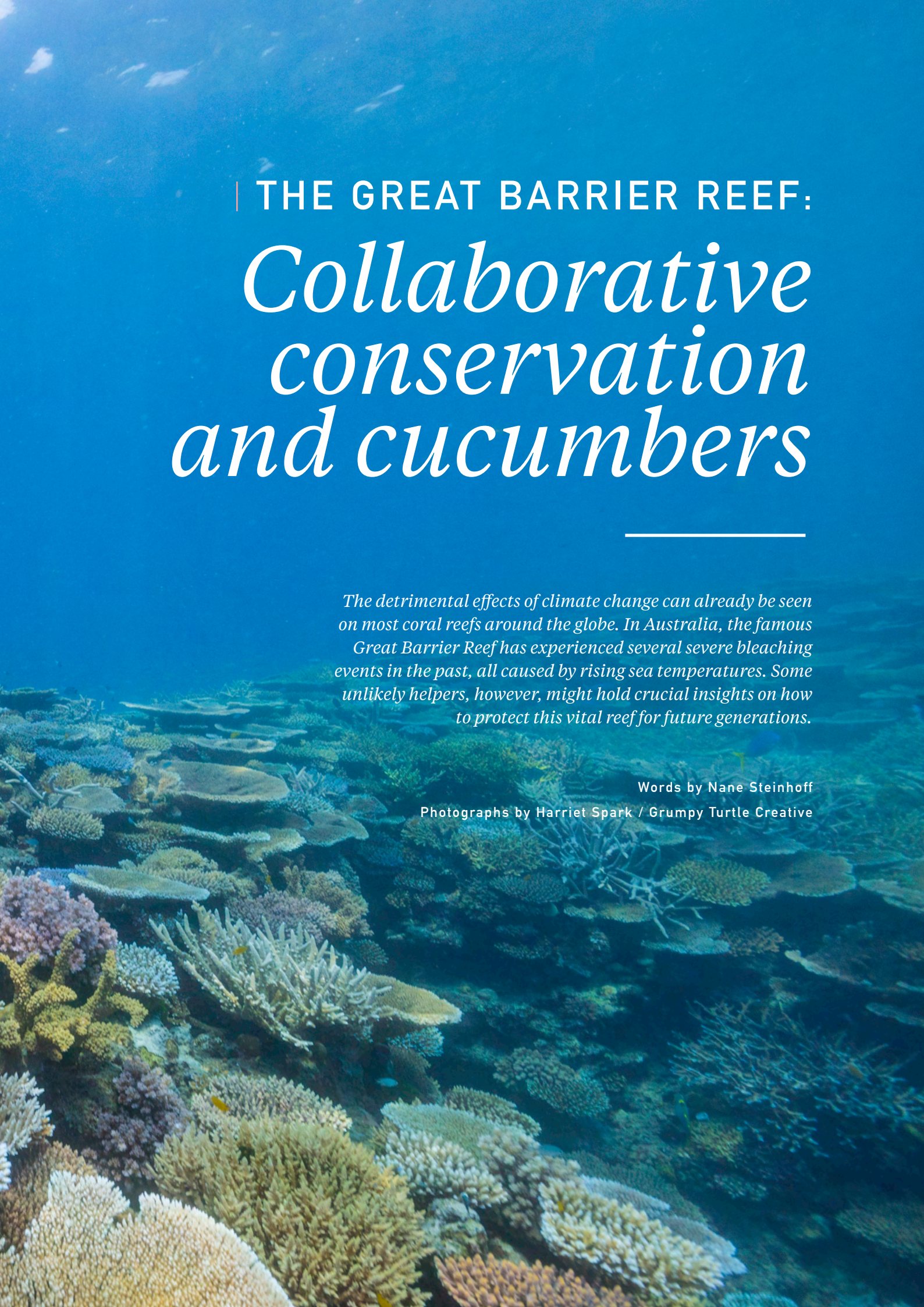




THE GREAT BARRIER REEF:

Collaborative conservation and cucumbers

The detrimental effects of climate change can already be seen on most coral reefs around the globe. In Australia, the famous Great Barrier Reef has experienced several severe bleaching events in the past, all caused by rising sea temperatures. Some unlikely helpers, however, might hold crucial insights on how to protect this vital reef for future generations.

Words by Nane Steinhoff

Photographs by Harriet Spark / Grumpy Turtle Creative

Elongated, alien-like bodies lined with tube feet. Long tentacles cover their mouth. While sea cucumbers might not have the looks, charm or charisma of a spinner dolphin or a great white shark, they are slowly emerging as a key species in the fight against climate change. Last year's Reef Women expedition, which was part of the Great Reef Census of 2021, a widespread citizen science effort to survey the Great Barrier Reef and capture large-scale reconnaissance data to help support research and management efforts, tried to collect further data on the importance of sea cucumbers. Over a six-day period, a team of 15 women established what role they play in the ocean ecosystem of the Great Barrier Reef, while also assessing the distribution of seagrass, amongst other things.

As part of the Reef Women expedition, a small team of women, comprising of female scientists, indigenous rangers, local tourism industry divers, master reef guides and conservationists trialled new and innovative methods to survey the world's largest natural wonder and monitor its health for the Great Reef Census, a project by the Citizens of the Great Barrier Reef conservation organisation.

"With Reef Women I really wanted to bring together a diverse group of women who work on the reef in different capacities, but all passionate about protecting it for future generations. But there are of course larger issues at play. A recent report found that women and minorities are still vastly underrepresented in coral science globally. So, part of why this trip was conceived was to help highlight some of the important and growing contributions of women working in this field – and hopefully inspire some young girls and women considering a career in reef science and conservation as a result," explains Kate O'Callaghan, former director of communications at Citizens of the Great Barrier Reef at the time of last year's Reef Women expedition.

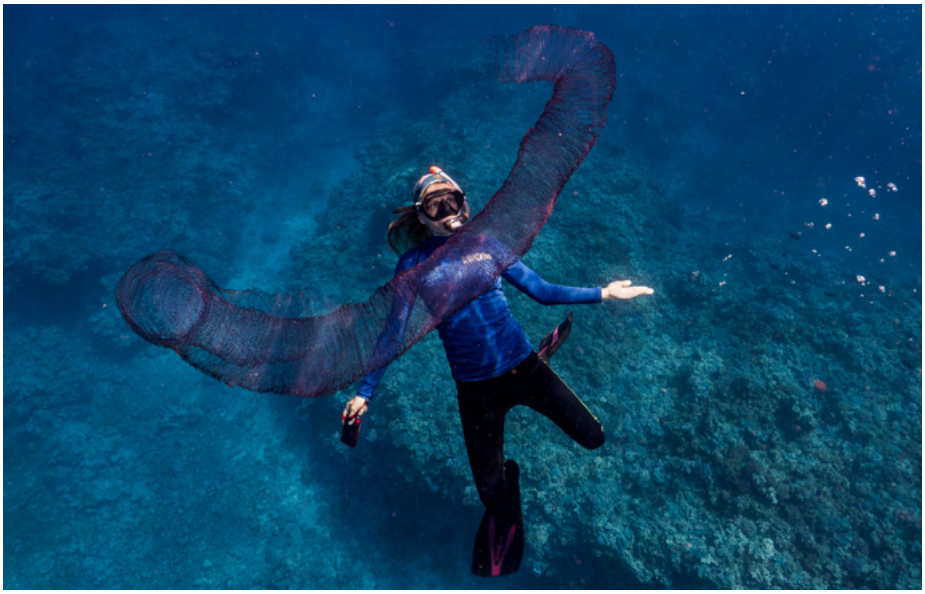
By reaching and surveying 46 priority reefs and 120 sites around the remote Ribbon Reef, the team was able to capture more than 11,000 reef survey images for the Great Reef Census; an important step towards supporting reef research and management in the face of accelerating climate change. This collaborative citizen science approach can also help fill some of the knowledge gaps identified by scientists and reef managers. "Despite being on a boat far from shore, we were able to upload images with GPS to the project platform using edge devices - a key piece of tech that we co-developed with Dell to enable data upload from remote locations," explains O'Callaghan. "While the primary aim was surveying priority reefs for the Census, ultimately our goal as an organisation is to build a collaborative, scalable conservation model that can be shared with other reef communities both in Australia and globally. With this in mind, we trialled some additional research projects on board to see if our Census infrastructure could also support data collection at scale for things like seagrass and sea cucumbers."

She adds: "The Census methodology is designed so that any competent snorkeller with a GoPro can do it - its simplicity is key. A survey is made up of 20 photos from a reef site taken at regular intervals on a snorkel, from a distance of at least 3m. This should be repeated on all four sides of a reef — fore reef, back reef, and the transitional zones — to count as a reef surveyed. While simple, it has been developed with some of the reef's leading scientists and was tested and verified during last year's Census, so we can be confident the data captured is valuable."

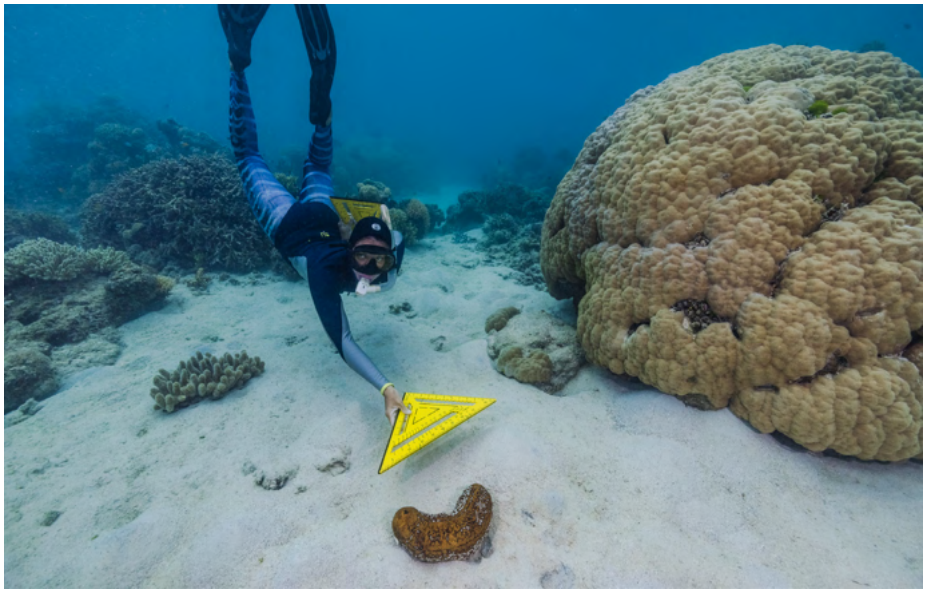
Throughout the survey, the team took a closer look at sea cucumbers, a keystone species on the Great Barrier Reef. Just like starfish or sea urchins, they are marine invertebrates. Characterised by their leathery skin and long bodies, they can be found on seafloors all over the globe. The sea cucumber's feeding mechanism is the secret to its role as a vital climate change aide. "Sea cucumbers might look unassuming, but they play an important role in the marine ecosystem. By eating sand and discharging sand, they clean the sediment and create a more favourable environment for other animals to live in," explains Dr Abbi Scott, from James Cook University, who led the seagrass research on the latest Reef Women expedition. After feeding on algae, waste particles or tiny marine critters,

PREVIOUS: Researcher Dr Abbi Scott conducts a coral survey.
THIS PAGE: By eating and discharging sand, sea cucumbers clean the sediment.

“The sea cucumber's feeding mechanism is the secret to its role as a vital climate change aide.”



"Only around 5 to 10% of the Great Barrier Reef is regularly surveyed."



TOP: Swimming with a pyrosome that consists of pelagic colonial tunicates.
MIDDLE: A sea cucumber up close.
BOTTOM: One of the team members measures the length of a sea cucumber.

sea cucumbers break down their food into even smaller pieces inside their stomachs which then get recycled back into the ocean and become food for bacteria. Basically, the species has a similar function to earthworms on land. They can reduce the impacts of ocean acidification in areas where they are present, according to Scott: "As more carbon dioxide is being released into the atmosphere and is absorbed by the ocean, it slowly makes the ocean more acidic. Sea cucumbers can help to combat this by dissolving calcium carbonate as they eat the sediment. As calcium carbonate levels in the water increase it becomes less acidic, therefore locally buffering the impacts of ocean acidification."

To learn more about the extent to which sea cucumbers help combat ocean acidification, the species first needs to be effectively monitored. That, according to Scott, is a difficult thing to do: "Sea cucumbers are important to the Great Barrier Reef, but on the reef scale we don't know much about their distributions. By trialling and using methods that can be applied on a larger scale, we can start to understand more about sea cucumbers to help inform management and conservation of the species."

The Reef Women expedition team trialled new methods and different techniques to assess and monitor sea cucumber populations to fill this knowledge gap. "We used aerial drones at low tide to map shallow reef top areas and spot sea cucumbers," Scott says. "We then compared the footage with both snorkel surveys and in-water photo surveys. All these surveys were carried out along the same transect so they could be compared, and we can understand which methods would be most effective to scale up on the Great Barrier Reef."

In total, more than 5,700 drone mapping images were captured across 20 missions. Scott adds: "The findings collected through this survey approach will be used to help inform a larger scale monitoring project looking at sea cucumber populations on the Great Barrier Reef more broadly." This is important as no system currently exists to monitor the species despite there being a commercial fishery in its range.

Spanning 2,300km in length and comprising more than 3,000 individual reefs with incredible biodiversity that support more than 64,000 jobs, only around 5 to 10% of the Great Barrier Reef is regularly surveyed. Due to the reef's enormous size, the impacts of coral bleaching or weather events can affect some reefs more than others.

With increasing climate change impacts changing reefs, broader monitoring and the collection of up-to-date, widespread information on the state of these sites would be an important step to better understanding the Great Barrier Reef as a whole and assessing which conservation steps work and which might not be effective. "During the Reef Women expedition, we witnessed the impacts of recent disturbance events including mass bleaching events and major cyclones, with some reefs very badly impacted," says O'Callaghan.

"Despite these impacts, we also saw some beautiful reefs with incredible marine life, as well as reefs in a state of recovery and that's important — the story of the reef is not black and white; with more than 3,000 reefs it's more of a patchwork ecosystem. The Great Reef Census is all about finding out why individual reefs are changing year-on-year and why some are being impacted more than others."

Another ecosystem the Reef Women expedition was particularly interested to study was seagrass habitats – there is more seagrass than coral on the Great Barrier Reef. Seagrass not only provides a habitat for threatened species like dugong and sea turtles, it also acts as a critical blue carbon store. "Seagrass meadows are important to combat climate change because they absorb carbon efficiently and keep it stored for millennia," explains Scott. "Our knowledge of seagrass distribution in the Great Barrier Reef is based on some intensive surveys, such as in port areas, however much of this information comes from historic surveys or modelling which predicts the presence of seagrasses.

As the Great Barrier Reef is so large it is difficult to survey the whole area. On our Great Reef Census trip we were aiming to visit some of the areas that had not been surveyed recently to see whether any seagrass was present, and identify the seagrass species."

To map previously unmapped seagrass patches, more than 20 underwater camera tows were deployed. "We used a camera which was deployed off the back of a boat. It had a live feed up to a computer on the boat so we could see in real time what was on the sea floor and the footage was also recorded so we could review it back in the office. The camera was towed for 100m at each site to look for the presence of seagrass. Some of the areas we were looking in had never been surveyed before, and some only had seagrass data from more than ten years ago," says Scott. "We found seagrass meadows at 48m depth. While seagrass meadows have been found at this depth before on the Great Barrier Reef, it's amazing to see a plant able to survive at that depth."

The team of scientists hopes that these new techniques will be used by citizen scientists and other reef-based industries in the future to support data collection at scale. O'Callaghan explains: "For me, Reef Women is an important opportunity for collaboration and knowledge-sharing amongst people who may work on the same ecosystem, but don't often have the reason or opportunity to interact.

"We had tourism crews learning how to conduct seagrass tows, Indigenous rangers flying drones, and seagrass scientists doing coral surveys with a GoPro. If we're going to scale-up conservation this decade, which needs to happen in parallel with dramatic emissions reductions, these types of partnerships between tourism, science, conservation and the broader community will become increasingly important."