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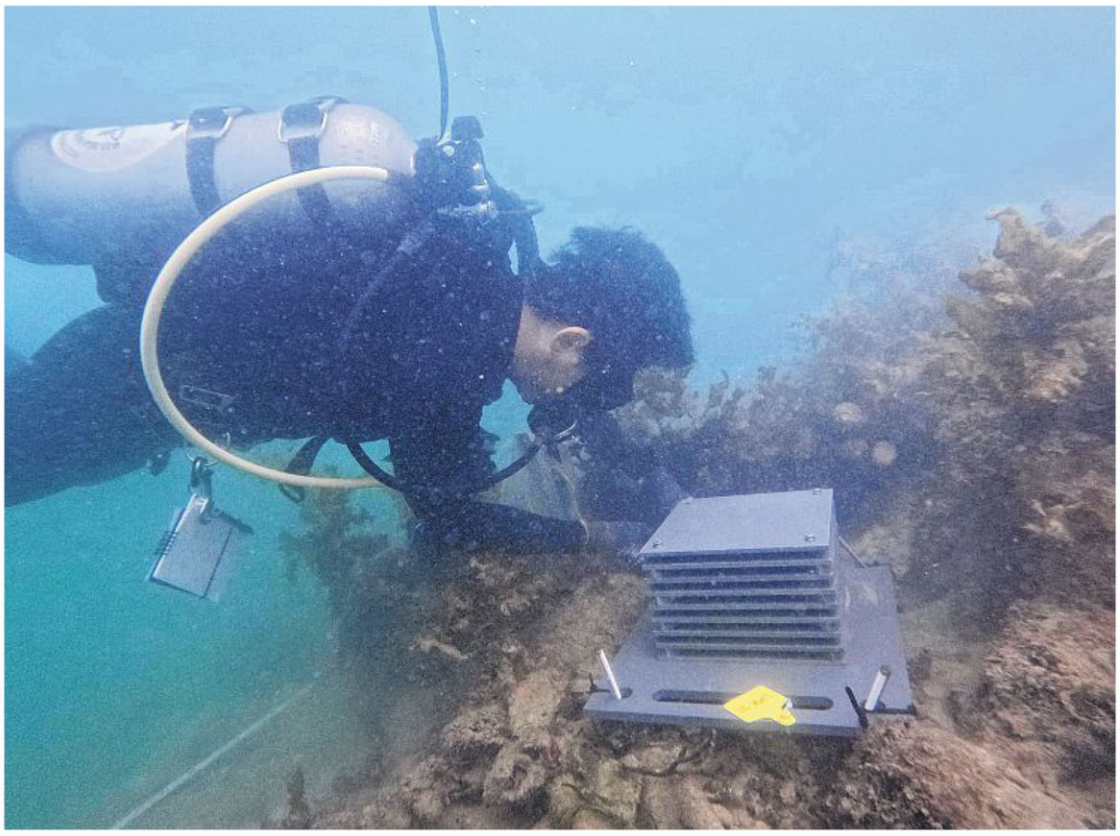

NUS marine biologist Huang Danwei checking on an autonomous reef monitoring structure off Pulau Semakau. More than 40 of the structures have been anchored at seven sites as part of a marine biodiversity survey. ST PHOTO: AUDREY TAN

ST Explains

How Sisters' Islands Marine Park is bringing science from lab to life

Shabana Begum and Chin Hui Shan

The Sisters' Islands Marine Park, which reopened to the public on Oct 28, is not just a place to bring people closer to Singapore's underwater life.

It is also a living laboratory for marine scientists in Singapore to study corals, fish and other marine creatures that adorn the country's coastal areas – and where people can get up close with the research.

By allowing people to peer into the carved openings on the new floating boardwalk to see coral experiments or wade in the lagoons to see how seagrass and mangroves can be restored, the revamped Big Sister's Island will help bring marine science from lab to life.

But the marine science scene in Singapore extends beyond the marine park. As part of a region thronging with islands and coastal seas, many research groups in Singapore are embarking on research to better understand marine biodiversity.

On Oct 28, Minister for National Development Desmond Lee gave an update on some of these research programmes, including the launch of Singapore's second comprehensive marine biodiversity survey.

WHAT IS THE AIM OF THE SECOND COMPREHENSIVE MARINE BIODIVERSITY SURVEY?

The first survey that was completed almost a decade ago had mapped out the types of marine life found across three habitats in Singapore's waters – intertidal mudflats, coral reefs, as well as the soft, submerged parts of the seafloor.

Through these surveys, an estimated 72,000 specimens were collected. From them, over 37 species new to science and more than 300 species never found in Singapore before were discovered.

"While (the first phase) was a huge step forward in revealing Singapore's marine biodiversity, not everything could be covered," said Associate Professor Darren Yeo, head of the Lee Kong Chian Natural History Museum (LKCNHM) at NUS.

The museum is one of three organisations helming the new, roughly five-year survey, alongside the NUS Tropical Marine Science Institute and the National Parks Board (NParks).

"To address such knowledge gaps, in (the second phase), NUS will employ new and different approaches... to uncover poorly studied hidden biodiversity in and around Singapore reefs," added Prof Yeo.

This initiative will focus on unearthing tiny organisms thriving in seafloors and inside the crevices of corals. These include tiny crustaceans, marine worms and foraminifera – single-celled creatures with shells smaller than a grain of sand. Many of these organisms are between 0.5mm and 2mm in size.

Scientists will use seabed corers to collect and sieve out the tiny creatures at different depths of the sand and seabed.

Knowing what lives in different depths can help scientists intervene better when an area is damaged. For example, if an oil spill smothers the top layer of an intertidal area, the organisms deep below could be unscathed.

"If biodiversity is surviving at lower depths, we can rehabilitate the top layer... if the oil only impacted the first layer, it means intervention is simpler," said Dr Karenne Tun, director at NParks' National Biodiversity Centre.

LKCNHM's deputy head Huang Danwei also expects new species to be discovered from the five-year survey.

Mr Lee added: "(The survey) will help us make more well-informed decisions regarding marine conservation, including how to better plan the use of our very limited sea space."

More than $2 million has been channelled to the second survey, with funds coming from organisations such as Dalio Philanthropies and HSBC Bank.

HOW WILL THE MARINE SURVEYS BE CONDUCTED?

Instead of dissecting a coral to see what lives inside it, researchers have deployed a layered device that mimics the structure of a coral, with gaps and nooks for worms and encrusting algae to settle on.

More than 40 of these autonomous reef monitoring structures have been anchored at seven sites around Singapore. After one to two years, the scientists will retrieve the devices to see what kinds of organisms have moved into these faux corals.

In this second phase of the marine biodiversity survey, scientists want to study lesser-known ecosystems by trying not to disturb fragile habitats.

And to do that, they are harnessing new technologies, such as the reef monitoring device and portable DNA sequencing tools, to quickly identify species.

HOW CAN ELECTRICITY HELP CORAL GROWTH?

To speed up growth, hard corals will be stimulated by low-voltage electricity to help make a type of calcium carbonate – similar to those naturally secreted by themselves – to build their skeletons, which are key building blocks of reef structures.

This is done through a chemical reaction called electrolysis.

These corals will be attached to underwater steel structures that will be connected to CoralAID Mineral Accretion (Cama) units that produce the electricity. These units are made of titanium and are powered by solar energy.

This electrical boost can also help strengthen the hard corals' resilience to threats such as ocean warming and acidification.

Studies in Thailand have shown that corals growing on similar structures were less susceptible to coral bleaching compared with wild corals. This is something NParks wanted to test here.

Amid the fourth global coral bleaching event on record, due to warming seas, Singapore's reefs have not been spared. In June, about 40 per cent of reefs in the shallow waters of the Southern Islands were bleaching.

Acknowledging that there are varying levels of coral bleaching across marine areas in Singapore currently, Mr Lee said NParks and research partners are closely monitoring the situation while studying coral bleaching responses and resilience.

This is the first time Singapore is trialling the Cama technology to stimulate the growth of hard corals by subjecting them to low-voltage electricity. The trials are being done at Bendera Bay at St John's Island and in a research pool at Big Sister's Island's boardwalk.

The growth rate of these corals will be monitored over a period of 12 months to assess whether the use of Cama units should be expanded to other parts of Singapore.

WHY ARE CORALS IMPORTANT AND WHAT ARE WE DOING TO SAVE THEM?

Coral reefs, which are built by hard corals over time, serve as habitat for more than 100 species of reef fish, about 200 species of sea sponges, and rare and endangered seahorses and clams, among other marine life.

They also play a pivotal role in providing coastal protection and serve as natural barriers against coastal erosion.

About 60 per cent of Singapore's reef area has been lost to land reclamation. Most of Singapore's intact coral reefs are found in the Southern Islands.

In 2018, man-made reef structures were installed in the waters off Small Sister's Island and were expected to contribute some 1,000 sq m of additional reef substrate to the Sisters' Islands Marine Park by 2030.

Over the next 10 years, 100,000 corals will be progressively planted and grown in Singapore's waters to beef up its reef cover.

The 100,000 corals initiative will scale up the country's existing coral restoration efforts, such as the Plant-A-Coral, Seed-A-Reef programme, which began in 2016.

The programme had helped to expand the reefs of Sisters' Islands Marine Park, with more than 700 corals planted and 16 artificial reef structures installed underwater.

nshab@sph.com.sg
chuishan@sph.com.sg