Source: *The Straits Times,* pA16
Date: 25 August 2025

Professor Paul Kench, from the NUS Department of Geography, cutting through a coral fossil in the Maldives in 2019. The fossil – or microatoll – records sea level rise each year as its skeleton grows layer by layer sideways. Each layer captures details about the ocean at that time. PHOTOS: NATIONAL UNIVERSITY OF SINGAPORE

Microatolls on a reef flat in the Maldives. The long-term record of rising seas as captured by the fossils can help to improve sea level rise projections, and optimise the design of nature-based protection measures, such as mangroves.

Coral fossil in Maldives shows sea level rise sped up far earlier than believed

Findings from study of coral skeleton reveal Indian Ocean's rise accelerated from 1959

Shabana Begum
Correspondent

The Indian Ocean's sea levels began accelerating from 1959, far earlier than previously thought, according to Singapore scientists who studied a coral fossil discovered in the Maldives.

Sea levels in the central Indian Ocean rose by 30cm between 1930 and 2019. This started with an annual rise of 1.42mm since 1930, before it accelerated to 3.44mm per year from 1959. Between 1992 and 2019, it rose 4.39mm per year.

These findings were published in scientific journal Nature Communications in July.

The century-old white, chalky fossil – called a microatoll – stores the memories of the Indian Ocean.

It records sea level rise each year because its skeleton grows layer by layer sideways, similar to how trees form rings. Each layer captures details about the ocean at that time, such as temperature, salt levels, and even sea level.

Such sea level archives are valuable because most existing records are from satellite data and tide gauges that go back only to the late 20th century. Most records from the central tropical locations in the Indian Ocean date back only up to 30 years.

"What we've now got is 60 more years of sea level records, which we never had in this part of the world. The Indian Ocean basin seemed to respond quite quickly to climate change," said Professor Paul Kench from the National University of Singapore's Department of Geography.

In 2019, he led a research team from his department and Nanyang Technological University (NTU) to visit the Maldives, where they found the 2.7m-wide coral fossil, which resembles a table, and brought back a cross-section of it for study.

The microatoll resides in the shallow waters of the Maldives' Huvadhoo atoll.

Microatolls can grow only to the height of the lowest sea level, as exposure to air kills them. Once the corals reach sea level, they continue to grow sideways and can therefore retain a record of sea level change.

The acceleration in the rise of sea level in the Maldives from the 1950s is caused by global warming and shifting wind patterns.

Strong winds blowing across the Indian Ocean brought cool water from the deep to the surface. Cooler waters have a greater capacity to absorb heat. When water heats up, its volume expands and contributes to sea level rise.

"This created a period where heat was being absorbed into the ocean surface a lot faster," Prof Kench said.

A long-term record of rising seas can help to improve sea level rise projections, and optimise the design of nature-based protection measures, such as mangroves and beaches, added the coastal scientist.

Long-term sea level patterns are key data for running models on coastal flooding.

Scientists using the data would be able to refine and "recalibrate their models of sea level behaviour for the whole Indian Ocean basin, and have a much improved accuracy in future predictions", said Prof Kench.

The Indian Ocean covers approximately 30 per cent of the world's ocean area and supports around 30 per cent of the global population.

Sea level data is critical for the region, given the abundance of low-lying coastal areas and islands, and heightened sea level risks to coastal communities and ecosystems, stated the paper.

While Singapore is far away from the Maldives and Indian Ocean, Prof Kench said: "Whatever we're observing in the central Indian Ocean has consequences for South-east Asia and Singapore... it's all connected."

The Strait of Malacca opens to the Andaman Sea, which is part of the Indian Ocean.

By 2100, Singapore's sea level is projected to rise by up to 1.15m. According to data from the Tanjong Pagar tide gauge, the average sea level has risen by around 14cm between 1989 and 2024.

Singapore is building a coastal-inland flood model that can simulate the dual effects of extreme sea levels and floods within land, based on the latest climate projections.

The findings unveiled by the coral fossil in the Maldives can help countries optimise how they harness nature to protect their coastlines, said Prof Kench, who has spent several years doing fieldwork in the Maldives.

For example, mangrove forests or their sediments can be further studied to find out how they have been responding to sea level rise since 1959. This can help conservationists fine-tune how mangroves can be harnessed as nature-based shields, including where to plant them. The complex roots of mangroves trap sediment from the tides, allowing them to keep pace with rising seas.

"At the moment, there's a tendency to plant mangroves everywhere and hope they work, because there hasn't been better knowledge about them," said Prof Kench.

NTU professor of coastal science Adam Switzer, who was not involved in the study, said: "New sea level insights are helping South-east Asia and Singapore sharpen climate models and unlock smarter, nature-based solutions, like reef and mangrove restoration, to build resilient coastlines for the future."

Singapore has ancient microatolls as well, in places such as Sentosa and the Southern Islands. The ones at Lazarus Island and Pulau Tekukor are around 7,000 years old.

Prof Kench said the local fossils are slightly more difficult to analyse because the nutrient-rich waters here and marine creatures have broken down their surfaces. This makes the skeleton's annual bands more difficult to detect.

To reconstruct sea level changes closer to home, Prof Kench visited a fossil-rich archipelago off Sulawesi, Indonesia, in mid-August.

He brought back some coral samples to put an initial age on them, and will return to the site next April to dissect a couple of microatolls.

"We're sandwiched by both Indonesia and Malaysia. If we can get sea level records from those two locations, that's going to be a record for Singapore... adds another level of improvement to our sea level prediction capabilities," he added.

Prof Switzer added: "In a world increasingly shaped by AI (artificial intelligence) and computer models, traditional field-collected data like this remains the heartbeat of discovery."

nshab@sph.com.sg