



# Designing seawalls on which marine life can thrive

Sloping walls could support more coral species, in bigger numbers

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Seawalls are increasingly being used as a buffer to protect coastlines from the effects of time and tide, and new research has found that these structures may not be incompatible with life underwater. Sometimes, they can bloom with coral.

Scientists here have found that compared with vertical structures, sloping seawalls can support a greater number of coral species, and in larger numbers too.

The National University of Singapore (NUS) research team decided to do this study after noticing coral growing naturally on seemingly barren artificial structures, such as seawalls. "We wanted to find out how different designs of the seawalls, whether vertical or sloping, support and affect the coral diver-

sity there," said the paper's lead author Kikuzawa Yuichi Preslie, a research assistant at NUS reef ecology laboratory.

The study was published last year in the scientific journal *Marine Biodiversity*.

Coral on seawalls can help to reduce the impact of waves beating against the shore, reducing coastal erosion, said Dr Toh Tai Chong, another author of the study and a senior lecturer at the NUS College of Alice and Peter Tan. Coral growing on these man-made structures have other advantages too, including serving as refugia for marine life. "This is especially important since land reclamation has removed much of the original coast," he said. "That said, seawalls cannot replace a natural coast."

The researchers first identified six seawalls along Lazarus Island, off Singapore's southern coast.

Three of the six were sloping seawalls at an incline of between 14 and 35 degrees from the seabed, and were made of granite boulders. The other three were vertical seawalls made of concrete.

The scientists donned scuba

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gear and descended underwater, recording the life forms and other abiotic – or non-living – components on the seawalls, such as sand or dead coral. They found that different types of life thrived on sloping and vertical seawalls.

Sand and silt may have accumulated more on sloping seawalls than on vertical structures, but these still hosted a larger number of reef-building hard coral species. Sixty-four species were recorded on sloping seawalls, compared with 35 found on vertical ones.

Vertical seawalls, on the other hand, were more conducive for the growth of macroalgae – which compete with hard coral for space.

Coral reefs and macroalgae mats support different types of marine life, with the coral playing host to a greater diversity of life forms, especially reef fishes such as groupers and snappers.

The researchers say that sloping seawalls provide a greater habitat area than vertical ones, and the uneven surfaces and crevices of the granite boulders help to create more nooks and crannies suitable for a wider range of species.

Dr Lionel Ng, a research fellow at the NUS Reef Ecology Laboratory and co-author of the paper, said the findings could inform future seawall designs, so coasts can be protected in a way that could encourage marine life to return. "This not only relates to seawalls, but also other artificial structures like pontoons and pilings," he added.

Ms Hazel Khoo, director of national water agency PUB's coastal protection department, said that apart from preventing floods, coastal erosion is another area the agency will look into as part of coastal protection against climate change impacts. "In developing adaptation measures to protect our coastlines, hybrid solutions – including seawalls with coral and living shorelines – will be considered," she said, adding that the efficacies of such hybrid measures will need further study.

Sloping seawalls also require more space compared with vertical seawalls, she noted. "PUB's upcoming site-specific studies will examine such measures and determine their suitability at specific segments of the coastlines," she said.

Mr Stephen Beng, chair of the Friends of Marine Park community, said sea-level rise and more-intense storms that worsen coastal erosion are not the only impacts of a changing climate. "We must also include measures that address sea temperature rise and ocean acidification, such as preserving nature within more marine protected areas," he added.

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Vertical and sloping seawalls at Lazarus Island. Researchers from NUS have found that sloping seawalls could host a greater diversity and abundance of coral life compared with vertical structures. PHOTO: NUS REEF ECOLOGY LABORATORY