New models to predict coral bleaching

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(Phys.org) -- Curtin University researchers have used computational fluid dynamics and powerful supercomputers to create new models for understanding and predicting coral bleaching.

A phenomenon that has increased in magnitude over the past two decades, coral bleaching is attributed to an elevation of sea surface temperatures combined with the sun's irradiation.

While bleaching is generally expected in response to a one to two degree temperature increase over a prolonged period, the new models consider phenomena such as coral porosity and permeability, morphology, mass and most importantly water flow and heat transfer.

Dr. Ben Mullins of Curtin's Fluid Dynamics Research Group said due to their shape and surface area, some corals are likely to be more susceptible to bleaching.

"One of the elements ignored until now is water flow, which can significantly influence the thermal microenvironment of the coral as water flows through and around it," he said.

"Basically, we've taken an engineering approach to an issue that biologists have been looking at for years and come up with a completely new method to predict how much corals warm."

He said outcomes from the computer models were shown to be consistent with outcomes from laboratory experiments, indicating

validity of the new approach.

“The models have the advantage of providing three-dimensional temperature and flow information down to very precise resolution compared to previous methods reliant on microprobes,” he said.

“They are also sufficiently flexible to accommodate large-scale in-situ modelling.”

Dr. Mullins said the next step was to apply the models more broadly to entire coral reefs.

“Given the scale of these structures, it’s very hard to get good data out in the field,” he said.

“Traditionally, researchers have measured temperature and flow at different points, which isn’t an accurate representation of the larger system.

“Our models are much more comprehensive.

“Given that the Great Barrier Reef is worth $6 billion from tourism alone to the Australian economy, there’s immense value in reef conservation.”

Coral consist of a calcite skeleton with a layer of living tissue. They live in a symbiotic relationship with zooxanthellae, single-celled plants/algae, with both providing nutrients for survival.

Coral bleaching occurs when zooxanthellae are expelled by coral or lose their pigmentation. Under some circumstances coral can recover, but in most cases they die.

Published in *PLoS One*, the research was spearheaded by Curtin's Fluid Dynamics Research Group with the Australian Institute of Marine Science.

Provided by Curtin University