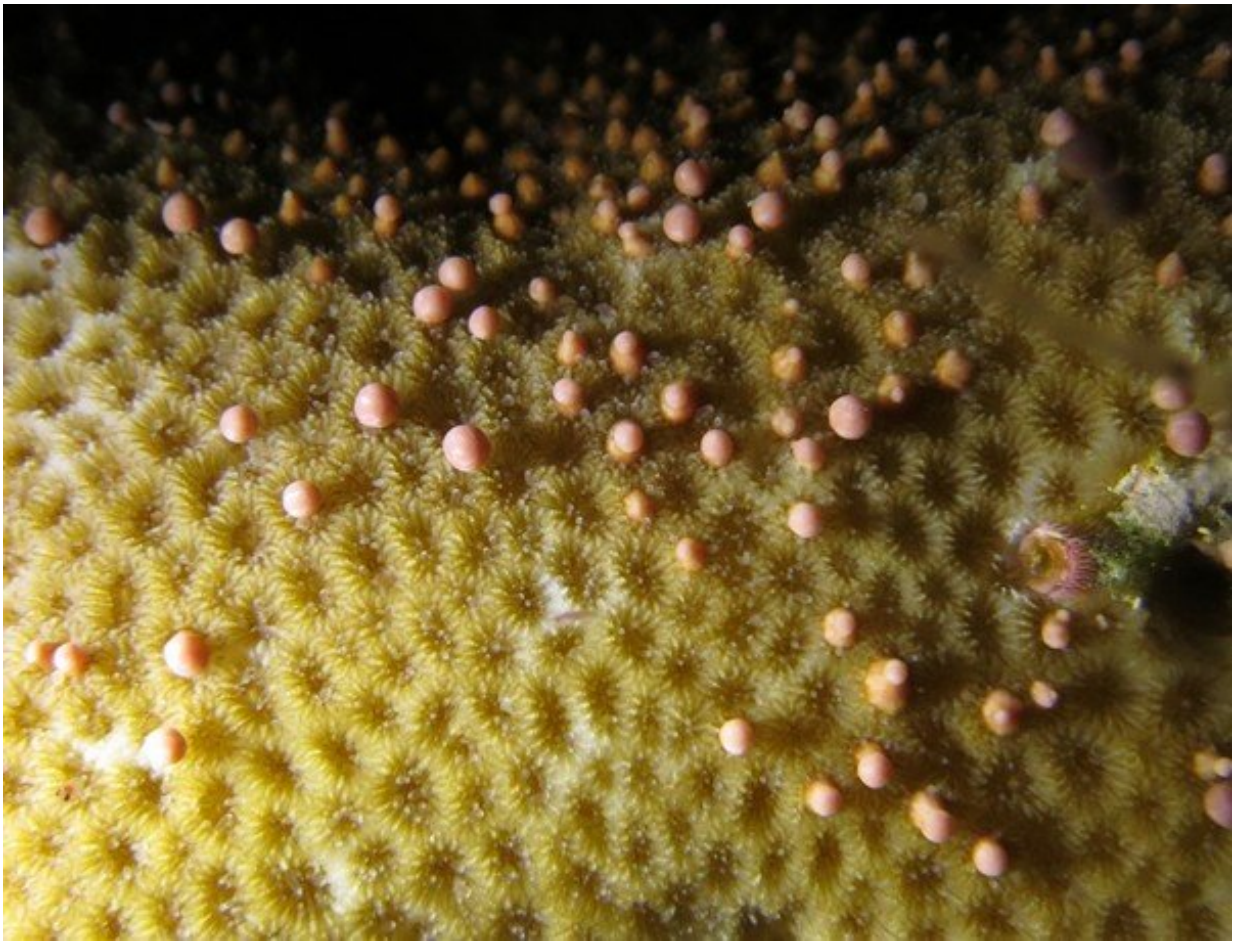
Why corals do not always pass on symbionts to their offspring

December 14 2017

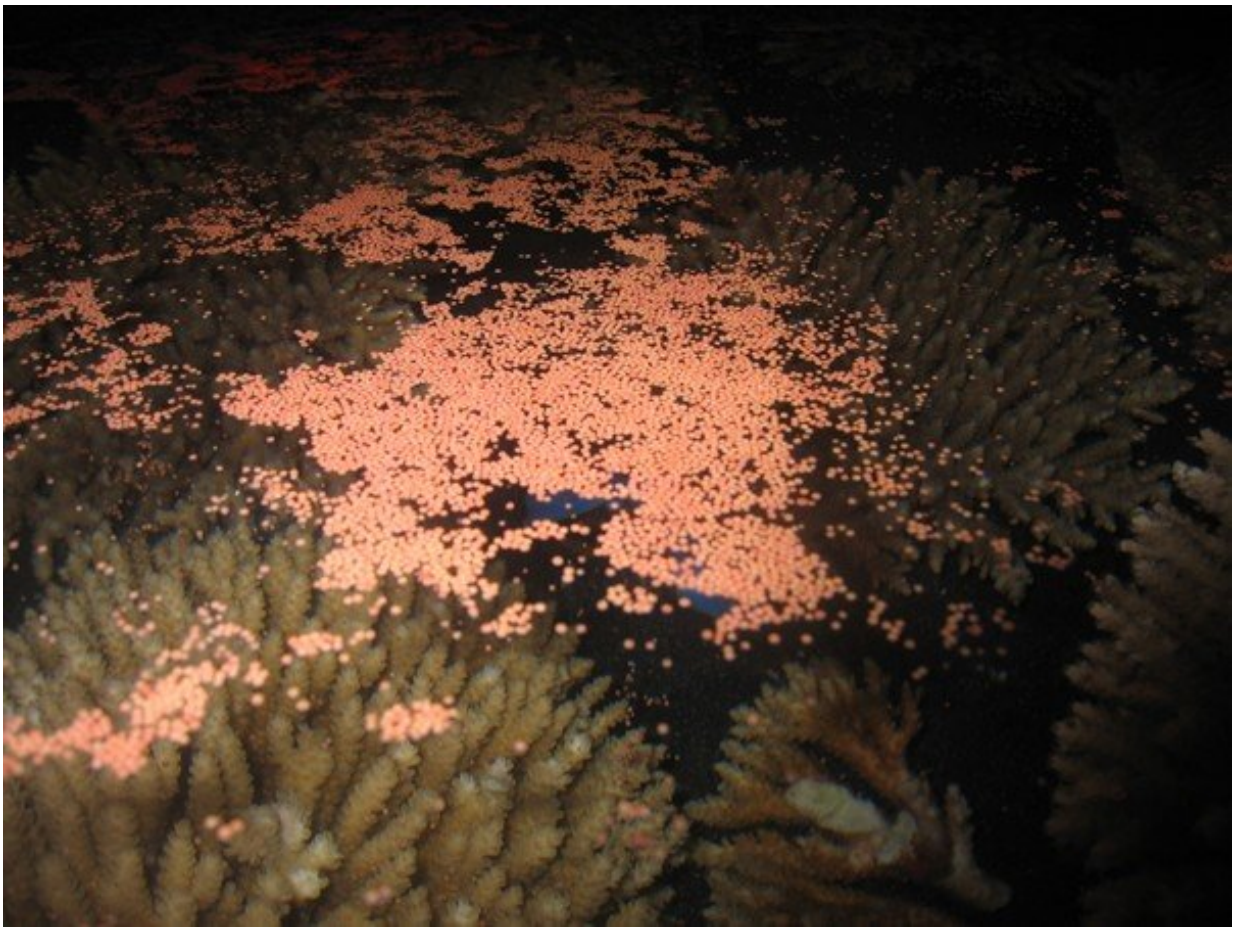


Reef coral Goniastrea releasing egg-sperm bundles free of symbiotic algae into the water. Credit: Andrew BAIRD

An NUS ecologist has discovered why, paradoxically, corals do not always receive symbiotic algae from their parents, even though these symbionts are likely to be well adapted to the environment.

Corals have a close and mutualistic relationship with microalgae symbionts (organisms that are very closely associated with another, usually larger organism), which are known as zooxanthellae. The zooxanthellae provide food for the corals in return for the accommodation and nutrients offered by the coral host. Theory suggests that corals should pass these symbionts directly to their offspring, rather than have them start with a clean slate and acquire symbionts from the environment. This is because symbionts present in the parents are likely to be already adapted to the environment and therefore advantageous to their offspring. However, many organisms, including most corals, do not pass symbionts directly to their offspring. Often, their offspring have to obtain the symbionts from the environment during their developmental stage.

Together with scientists from James Cook University and the Smithsonian Institution, Prof HUANG Danwei from the Department of Biological Sciences, NUS, and Dr Aaron HARTMANN from San Diego State University have discovered that the reproductive mode of coral species determines if corals acquire their symbionts from their parents or from the environment. Most corals which brood their young pass their symbionts to them. Those which broadcast their gametes for fertilisation often do not. This finding was obtained by studying their evolution over millions of years.



Egg-sperm bundles floating on the water surface, where high temperature and light may be damaging to their relationship with symbiotic algae. Credit: Andrew Baird

"Offspring broadcasted into the water column often disperse for large distances and are fertilised at the sea surface, where high temperature and light may hurt the symbiotic relationship. Therefore, by forgoing parental zooxanthellae despite their necessity later in life, coral larvae may actually survive better and even acquire symbionts which have adapted to their new environment," said Prof Huang.

Their findings help explain why the majority of corals acquire symbionts

from the environment, and advance the general understanding of how this critical mutualism has benefitted coral reefs. This is important for reef conservation efforts because the warming seas have resulted in the loss of these symbionts and death among corals. Knowledge of how these relationships are sustained across generations enables the prioritisation and restoration of species that are more likely to obtain symbionts which are fitter in a specific reef environment.

More information: Aaron C. Hartmann et al. The Paradox of Environmental Symbiont Acquisition in Obligate Mutualisms, *Current Biology* (2017). DOI: 10.1016/j.cub.2017.10.036

Provided by National University of Singapore