Can coral skeletal $\delta^{15}N$ be used as a proxy for past mass bleaching events?

MARÍA SALOMÉ RANGEL[1], DIRK ERLER[2], JESSICA RIEKENBERG[2], SANDER SCHEFFERS[3], LES CHRISTIDIS[1] AND JANICE LOUGH[4]

[1]National Marine Science Centre, Southern Cross University, Coffs Harbour, Australia.
[2]Centre of Coastal Biogeochemistry, Southern Cross University, Lismore, Australia.
[3]Marine Ecology Research Centre, Southern Cross University, Lismore, Australia.
[4]Australian Institute of Marine Science, Townsville, Australia.

The nitrogen (N) isotopic signature of intracystalline coral skeleton organic material (CS-$\delta^{15}N$) is an emerging tool for studying coral reef N cycling in the past. Here we present a new application of the CS-$\delta^{15}N$ technique, namely to detect past episodes of thermally induced coral bleaching. To validate the new application, we measured CS-$\delta^{15}N$ in coral cores spanning the 1998 and 2002 mass bleaching events on the Great Barrier Reef (GBR) and compared this with other known proxies of thermal stress, i.e. increasing skeletal density and decreasing $\delta^{18}O$. In multiple coral cores from two inshore reefs (Nelly Bay and Pandora Reef) in the central GBR temperature stress events coincided with increases in CS-$\delta^{15}N$ relative to non-stressed corals. This is likely due to a shift towards a heterotrophic diet following the expulsion of zooxanthellae during high temperature periods. Increases in CS-$\delta^{15}N$ or skeletal density during temperature stress events were not as pronounced in coral skeletons from a mid-shelf reef (Rib Reef), highlighting the spatial variability of thermal stress events in the GBR.. The implication of our study is that when combined with skeletal density and $\delta^{18}O$, CS-$\delta^{15}N$ may be a useful proxy for identifying episodes of pronounced reef temperature stress in the past.