# The insecure future of stony corals

## Could their fluorescence play a role in the detection of heat stress?

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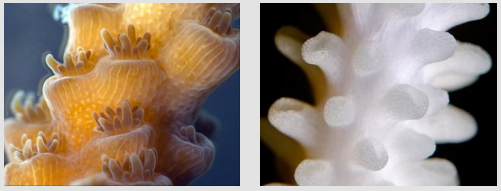
References

## The future of corals

Stony corals are the keystone species of coral reef ecosystems harboring the highest biodiversity of any marine ecosystem, covering only 0.1% of the ocean floor[1]. Fish collected from reefs build the main protein source for over 100 million people[1]. Their estimated value in ecosystem functions is over one trillion USD[2]. Nevertheless, in the last decade 14% of the coral reefs have been lost. Reasons for the drastic decline are nutrient inputs, ocean acidification, sedimentation, pollution and raising temperatures, because of anthropogenic climate change[3]. To save coral reefs the compliance to the Paris agreement and the limitation of global warming to 1.5°C is inevitable[4].

## Coral bleaching

Reef-building corals live in symbiosis with single-celled algae[5]. These provide about 90% of the needed nutrients and are responsible for the brownish color of the corals (left[6]). During heat periods, this symbiosis breaks and the symbionts are expelled[7]. Therefore, the coral loses its color and appears white (right[8]).



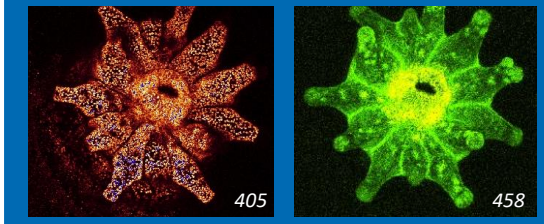
## What is fluorescence ?

Fluorescence is the transformation of light by chemical molecules. Molecules are excited by a certain wavelength of light and while relaxing, they release energy in the form of light.

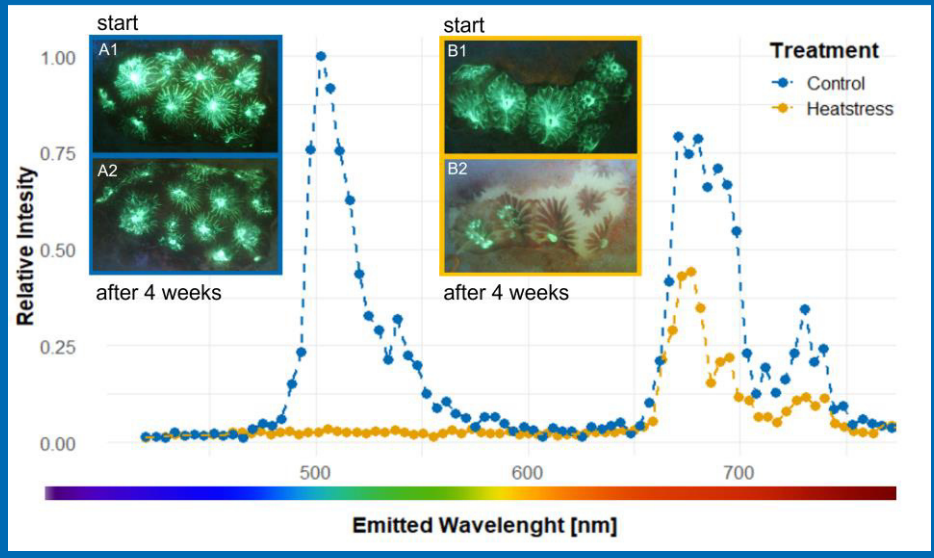
## Fluorescence in corals

Many stony corals fluoresce under certain excitation wavelengths. The main source of their fluorescence are proteins[9]. The role of these is still heavily debated among scientists. Some studies assume that the fluorescence can enhance the photosynthetic performance of associated symbionts[10], and the fluorescence can alter the composition of these. Even the attraction of symbionts[11] by fluorescence is supposed. Other studies assume a photoprotective role [12], especially in shallow reef areas, or antioxidant capacities[13] of fluorescence proteins.

## Confocal microscopy




A juvenile coral polyp excited with UV and blue light (405 and 458nm) and the resulting green, yellow (right) and red (left) fluorescence.




The emission spectra of adult corals excited with blue light (405nm) in different heat treatments and light microscopic pictures of a control (left) and stressed (right) coral.

## Shooting laser at corals

Experimental set up:

- corals at different life stages (juvenile and adult)
- different temperature treatments (28°C and 32°C)
- duration: 26 days

Monitoring during the experiment was performed with light microscopy. At the end, confocal microscopy was used in order to compare the corals in different heat treatments. Therefore, the corals were excited with laser of different wavelengths and emitted fluorescence distribution and spectra were measured.

## Can heat stress be detected with fluorescence ?

A loss of green fluorescence could be observed in heat stressed corals, even before symbionts and therefore the red fluorescence is expelled. Thus, the fluorescence can be used as a proxy for the health status of adult corals. Moreover, fluorescence can be used as an early indicator before bleaching. Nevertheless, further studies with different coral species and higher sample numbers are necessary to confirm these finding and determine the function of fluorescence in corals.

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