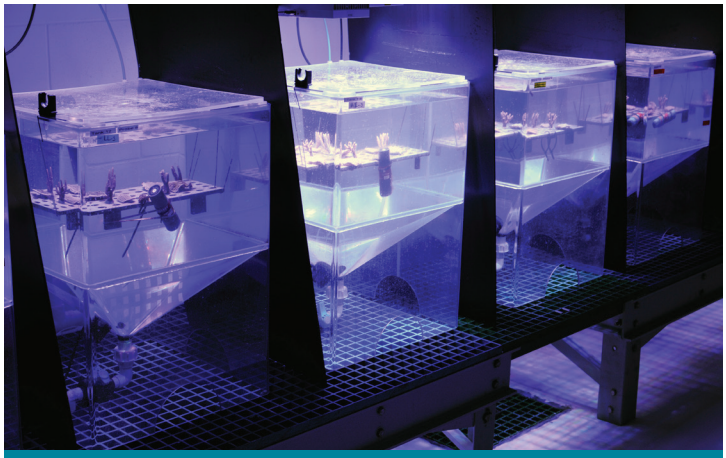
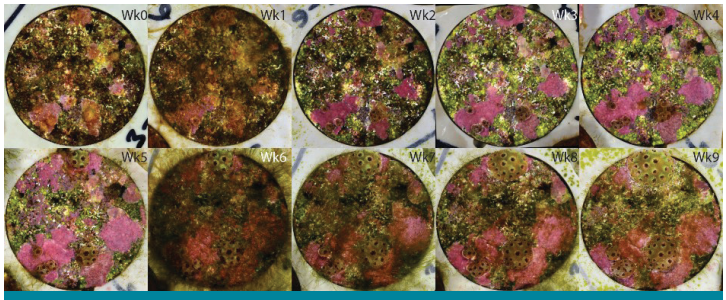
Outcomes Factsheet 1

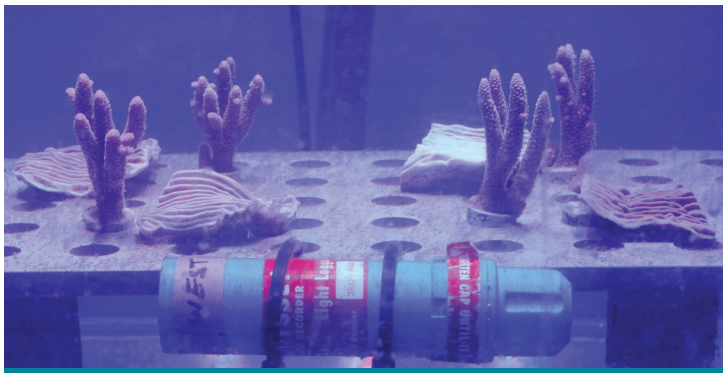
Project 5.3 Benthic light as ecologically-validated GBR-wide indicator for water quality: Drivers, thresholds and cumulative risks



Experiments conducted in AIMS SeaSim facilities tested how corals respond to high, low and variable light conditions (Copyright: Australian Institute of Marine Science. Credit: Sam Noonan)



The growth and survival of juvenile *Acropora* corals over a nine-week period in response to varying light conditions. Juvenile corals were settled on discs covered in a range of turfing (green and brown colours) and crustose coralline (pink colours) algae. Individual corals are circled in white at the beginning of the experiment. (Copyright: Australian Institute of Marine Science. Credit: Sam Noonan)



Close-up of small portions of adult coral colonies used as experimental units in SeaSim experiments. These *Pachyseris speciosa* (flat morphology) and *Acropora millepora* (branching morphology) colonies grew less as light decreased, regardless of the variability in delivery. (Copyright: Australian Institute of Marine Science. Credit Sam Noonan)

How do corals respond to different light conditions?

Corals form symbiotic relationships with algae, which provide extra energy for the corals by harvesting sunlight. We know that corals don't grow well if water quality is poor, in part because murky, turbid water reduces the amount of light that reaches underwater reefs. But how much light do corals need to grow at their best, and does it matter whether the light is constant or whether it varies over the course of the day between high and low light conditions? We ran some experiments to find out!

Although we already knew that most coral species grow best in clear waters with plenty of light, we didn't know exactly how much light they needed or whether short interruptions made a difference. In order to set better management targets and report on how water quality in the Great Barrier Reef is changing from year to year, we need to know what kind of light conditions corals need.

By analysing and modelling past bleaching events scientists can now identify regions most at risk of bleaching and importantly those areas that are persistently cooler – regardless of the vagaries of weather associated with each bleaching event.

We used the National Sea Simulator at the Australian Institute of Marine Science (AIMS) to experimentally test how several coral species, Pachyseris speciosa, Acropora millepora, A. tenuis and A. hyacinthus, responded to high light, low light, and varying light conditions. Although the results show different responses for different species of coral, all had dramatically-reduced growth in low-light conditions (6 mol photons m-2 d-1) and intermediate growth rates in variable-light conditions. Our results show that it is the cumulative amount of light that corals receive, regardless of how variable the delivery, which affects their physiology and growth. Even short periods of interruption to light, for example due to poor flood-plume water quality, reduce growth and recovery.

The full details of these experiments and the results of the first set of experiments is available online:

DiPerna, S., Hoogenboom, M., Noonan, S. and Fabricius, K., 2018. Effects of variability in daily light integrals on the photophysiology of the corals *Pachyseris speciosa* and *Acropora millepora*. PloS one, 13(9), p.e0203882 (http://bit.ly/30V6Uet)

Katharina Fabricius, AIMS
(07) 4753 4412 or k.fabricius@aims.gov.au

Barbara Robson, AIMS
(07) 4753 4324 or b.robson@aims.gov.au

This project is supported through funding from the Australian Government's National Environmental Science Program