

Discovery of a recovering climax *Acropora* community in Kanton Lagoon in the remote Phoenix Islands Protected Area

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Fig. 1. Climax *Acropora* community in Kanton Lagoon in the Phoenix Islands Protected Area in 2015. Photograph by Craig Cook.

An expedition in 2002 to the Phoenix Islands Protected Area in the Republic of Kiribati documented an extensive and delicate community of staghorn and tabular *Acropora* colonies (79.4% cover) in Kanton Lagoon, in a 2 km radius from the lagoon mouth (Obura *et al.* 2011). From July 2002, a thermal stress event developed and peaked at 21 degree heating weeks six months later. The stress was greater than any thermal event reported in the coral reef literature and resulted in near-100% mortality of corals in Kanton Lagoon, where *in situ* temperature loggers recorded temperatures reaching 31.1°C (Obura and Mangubhai 2011). A corresponding increase in coralline algae,

algal turf, and rubble was observed after the mortality (Obura and Mangubhai 2011). An expedition to the Phoenix Islands Protected Area in September 2015 documented a 52.8% recovery of hard corals, with cover at 41.9% (s.d. = 9.6%) (Fig. 1). Plating *Acropora cytherea* and *A. hyacinthus* dominated. Although the adult colonies in the lagoon experienced total mortality, there was enough survivorship on nearby forereefs to catalyse recruitment and succession of plating acroporids, though there was little to no recovery of staghorn corals. Such differential response by colony shape has been noted previously (Wallace 1985). In the Kanton lagoon, plating

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acroporid recruits settled onto dead *Acropora* plates, growing out in radial patterns covering old skeletons, such that the site closely resembled pre-bleaching *Acropora* stands. Average temperatures for the site fluctuate between 28.3 and 30.2°C (Obura and Mangubhai 2011). In 2015, temperatures exceeded these values with records as high as 30.5°C in the lagoon, measured by *in situ* temperature loggers, and temperatures reached 18 degree heating weeks. Additionally, there were *in situ* observations of forereef coral bleaching associated with the 2015/16 El Niño in the central Pacific (Brainard *et al.* 2018), yet there was almost no bleaching of *Acropora* stands within the lagoon (S. Mangubhai and Y. Nand, pers. obs.). Acroporids from the Coral Castles site in Kanton lagoon were observed to remain in healthy and recovering status in 2016 and as of 2017 and 2018 (R. Rotjan and J. Witting, pers. obs.). This suggests that these recovering species in the lagoon are more resistant to thermal stress.

Conflicts of interest

The authors declare no conflicts of interest.

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