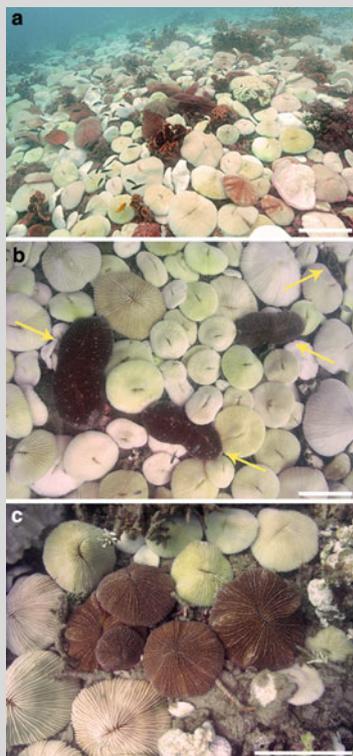


# Contrasting bleaching patterns in mushroom coral assemblages at Koh Tao, Gulf of Thailand

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**Fig. 1** Mushroom coral bleaching at Koh Tao (scale bars 20 cm). **a** Assemblage at Twin Rocks (3–4 m depth). **b** Four unbleached (brown) *Ctenactis echinata* corals in an otherwise bleached (white) multi-species assemblage, SE Nangyuna Island (3 m depth). **c** Brown *Fungia fungites* corals among white specimens of other fungiids, Sairee Beach (2 m depth)

Extensive fields of free-living mushroom corals (Scleractinia: Fungiidae) on reef flats and upper slopes (<7 m) around Koh Tao showed massive bleaching (Fig. 1a) after rising seawater temperatures during mid-April 2010. Using the roving diver technique (Hoeksema and Koh 2009), we examined the prevalence of bleaching in individuals belonging to 19 fungiid species encountered during 21 dives (June 25–30). At seven sites with deep slopes (18–30 m), maximum bleaching limits appeared demarcated at approximately 20 m, resulting in species commonly occurring below those depths to be little affected. At shallow depths (<20 m), a species-specific effect was observed. For example, all corals of *Ctenactis echinata* (Pallas, 1766), which was common on upper slopes, appeared to have remained unbleached, displaying a brown coloration (Fig. 1b). There was further fine-scale variation within species, as individuals of *Fungia fungites* (Linnaeus, 1758) found on the upper slopes (3–8 m) were predominantly bleached, while those on the reef flats (<3 m) had not bleached or only partly (Fig. 1c). Intraspecific differences regarding bleaching susceptibility in *F. fungites* can be explained by a higher tolerance to elevated seawater temperatures in shallow-living individuals (Hoeksema 1991).

In comparison with a previous study on 21 fungiids in shallow depths ( $\leq 21$  m) off Jakarta (Hoeksema 1991), a much clearer relation between fungiid bleaching and depth was observed at Koh Tao, owing to larger concentrations of free-living fungiids across a greater depth range. In contrast with the present results, *C. echinata* was among the bleached species on the reefs off Jakarta, while *Heliopora actiniformis* (Quoy and Gaimard, 1833), absent at Koh Tao, was the only fungiid not to have bleached. Although interspecific differences in bleaching susceptibility among taxa have been noted before (Baird and Marshall 1998; Loya et al. 2001), few studies have concentrated on the patterns of bleaching among phylogenetically closely related coral species as described here.

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# Reef sites

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