



Bleaching in the giant clams *Tridacna gigas* after typhoon Megi

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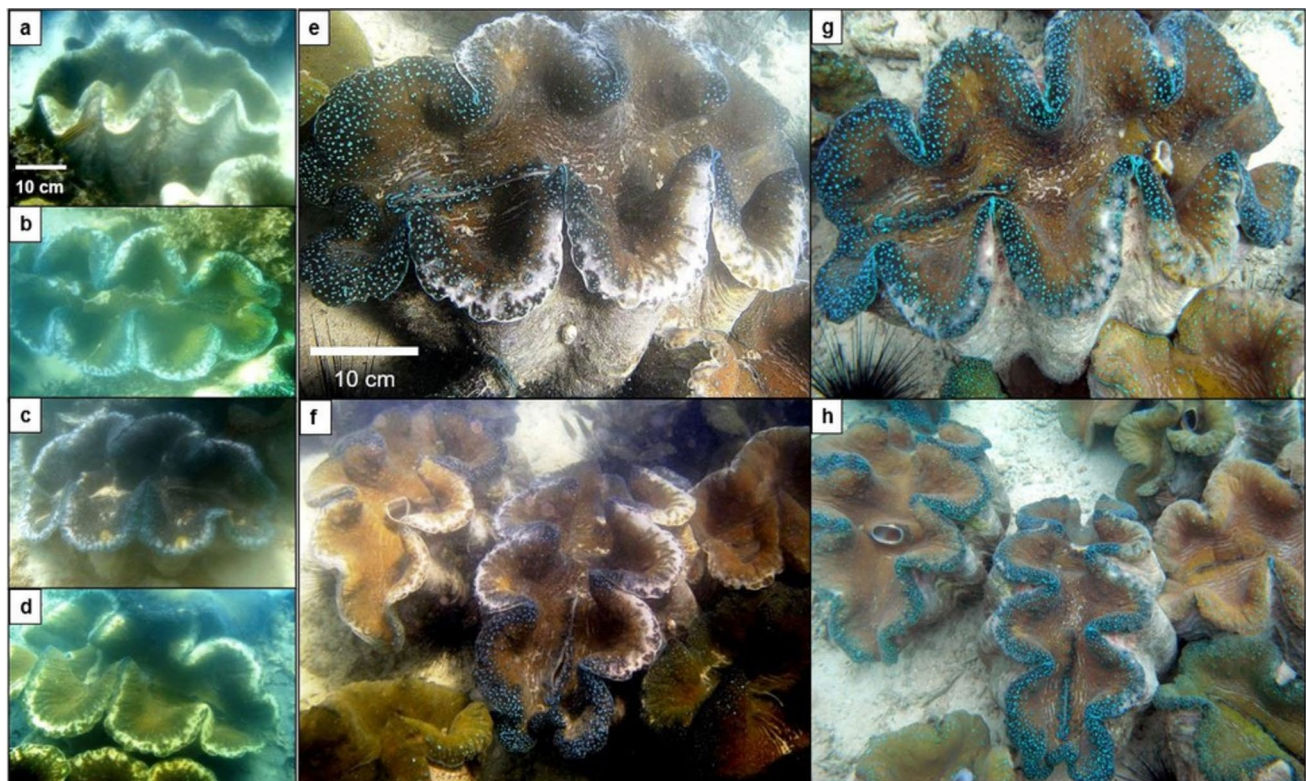


Fig. 1 Bleaching of *Tridacna gigas*, shell lengths 50–60 cm, observed in the Bolinao Marine Laboratory's ocean nursery after typhoon Megi (October 2010). **a–f** Bleaching pattern along the mantle mar-

gins of giant clams. **e–f** Examples of giant clam bleaching one day after typhoon Megi, and partial to complete recovery of the same bleached clams, **g–h** respectively, 35 days after the typhoon

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Bleaching in giant clams is the whitening of the mantle due to the expulsion of the symbiotic zooxanthellae (Norton et al. 1995). The frequency of bleaching events is predicted to increase as sea surface temperature continues to rise, attributed to the effects of global climate change (Pittock 1999). Other effects of changing climate, bringing extreme weather events such as intensified storms and typhoons (Pittock 1999), may also lower salinity and cause bleaching and mortality in corals (van Woessik et al. 1995). In giant clams, bleaching has been mostly linked to elevated sea water temperatures, but the effects of extreme weather conditions remain understudied. Regular monitoring of giant clam

populations following severe weather conditions is crucial for assessing clam resilience to such weather disturbances.

In this study, we report the bleaching in giant clams *Tridacna gigas* related to typhoon Megi. Typhoon Megi entered the Philippine Area of Responsibility as a super typhoon but was downgraded to a severe typhoon after landfall in northern Luzon. On October 19, 2010, with maximum winds of 175 km h⁻¹ and total rainfall of 510 mm, Megi was 180 km west of Bolinao, Pangasinan, where a giant clam ocean nursery was being maintained by the Bolinao Marine Laboratory of the Marine Science Institute, University of the Philippines. A day after the typhoon, no fresh mortality was observed but clams showed mild to moderately bleached mantle margins (Fig. 1a–f). During the post-typhoon assessment of the nursery on November 3, 2010, we documented 1162 bleaching clams out of 49,716 clams. In this assessment, 45% of bleaching (518 clams) was attributed to typhoon Megi (Fig. 1a–f). The 55% (644 clams) with moderate to severe mantle bleaching was attributed to elevated surface temperatures during the 2009–2010 El Niño event. Compared to previous July 2010 data (361 bleached clams), bleaching increased in the ocean nursery threefold after typhoon Megi.

Typhoons may cause acute reductions in temperature and salinity in shallow marine environments, where marine organisms may develop adaptation mechanisms to survive. While bleaching due to increasing temperature is well-documented in corals, low-temperature stress also affects corals and giant clams (Hoegh-Guldberg et al. 2005; Lee et al. 2024). In this study, the synergistic effects of cold stress and reduced salinity alongside mechanical stress from strong underwater surges and increased turbidity may have caused the observed bleaching. To avoid these stressors, *T. gigas* can adduct its shells, but only for short periods. *Tridacna gigas* cannot fully retract its large fleshy mantle and may become exposed to external stress, resulting in bleaching along the mantle margins. No bleaching was observed in sub-adult *T. gigas* and smaller giant clam species that can fully shut their valves despite being half-buried in the sediments. After several days of improved weather conditions, bleached mantle margins began regaining coloration from the regrowth of zooxanthellae (Fig. 1g, h). On November 23, 2010, 83% (429) of the clams that bleached due to the typhoon fully recovered.

From 2011 to 2024, at least eight typhoons hit northwestern Luzon; however, no similar bleaching event was observed in the nursery. The intensity of these typhoons was not as strong (130–165 km h⁻¹) as typhoon Megi and/or did not pass near Bolinao. Our observations, however, differed from what was observed in other areas. The high turbidity after a typhoon resulted in mass mortalities of *T. derasa*, *T. squamosa*, and *T. crocea* in Southern China (Li et al. 2025). Mass mortality in *T. gigas* was also observed after severe weather conditions that reduced the salinity from 35 to 10–11 ppt in Orpheus Island, Australia (O’Neil 2025). Nonetheless, together with our observations, the predicted intensification and increasing frequency of typhoons will further threaten giant clams.

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Declarations

Conflict of interest The authors declare no competing interests.

Ethical approval No animal testing was performed.

Sampling and field studies Permits for observations have been obtained by the authors.

Data availability All data relevant to this study are included in this article.

Author contribution EAM and SML conceived the study. EAM and PCC conducted the observations. EAM drafted the manuscript. All authors read and approved the manuscript.

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References

- Hoegh-Guldberg O, Fine M, Skirving W, Johnstone R, Dove S, Strong A (2005) Coral bleaching following wintry weather. *Limnol Oceanogr* 50:265–271
- Lee RP-T, Lin Y-R, Huang C-Y, Nan F-H (2024) Effects of nutrient source, temperature, and salinity on the growth and survival of three giant clam species (Tridacnidae). *Animals* 14:1054
- Li J, Li Z, Zhao Z, Guo S, Ma H, Qin Y, Yu Z, Zhang Y (2025) Growth and survival of three hatchery-bred giant clams (*Tridacna derasa*, *T. squamosa*, and *T. crocea*) in an ocean nursery: a pilot of restocking study in China. *Mar Biodivers* 55:25
- Norton JH, Prior HC, Baillie B, Yellowlees D (1995) Atrophy of the zooxanthellal tubular system in bleached giant clams *Tridacna gigas*. *J Invertebr Pathol* 66:307–310
- O’Neil R (2025) Giant clam garden a victim of severe weather. James Cook University Australia. <https://www.jcu.edu.au/news/releases/2025/march/giant-clam-garden-a-victim-of-severe-weather#>. Accessed 06 June 2025
- Pitcock AB (1999) Coral reefs and environmental change: adaptation to what? *Amer Zool* 39:10–29
- van Woesik R, De Vantier LM, Glazebrook JS (1995) Effects of cyclone ‘Joy’ on nearshore coral communities of the Great Barrier Reef. *Mar Ecol Prog Ser* 128:261–270

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