

Coral bleaching in Guadeloupe Island in 2023

Blanqueamiento de corales en la Isla de Guadeloupe en 2023

Le blanchissement corallien en Guadeloupe en 2023

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EXTENDED ABSTRACT

A sea water temperature of 29°C is the commonly accepted tolerance limit for most coral species in the Caribbean region. In Guadeloupe Island, this limit was exceeded at the end of June 2023 in the open sea and shallow confined areas at the beginning of May. The maximum values were reached at the end of September, with 31°C in open sea environment and 32.4°C in shallow confined areas. Temperatures below 29°C reappeared at the beginning of December 2023. Temperatures above 29 °C lasted about 150 days in the open sea and up to 200 days in confined areas. This phenomenon has led to a severe bleaching of the corals of Guadeloupe. During the coolest month of 2024 (February), the temperature did not drop below 27.3°C in the open sea and still reached 28.8°C in shallow lagoons. The temperature again exceeded 29°C from May to December 2024, depending on the site. This corresponds to approximately the same period as in 2023. The maximum temperatures reached were similar to those of 2023. However, in December 2024, the water temperatures were still above 29°C.

The impact of coral bleaching was studied in 2023 at 26 sites around the island and in 2024 at a subset of 18 sites. Coral bleaching and subsequent mortality were quantitatively evaluated (linear intercept transects) at four GCRMN (Global Coral Reef Monitoring Network) sites monitored for more than 20 years. In addition, all the sites (including GCRMN) were quantitatively monitored by roving techniques. This method consists of counting and examining the health status of all the coral colonies encountered during a dive. Thus, during the two years, 11,423 coral colonies were examined. In parallel, reef fish communities were quantitatively studied at the GCRMN sites. Reef-associated fish were also quantitatively monitored by linear transects at GCRMN sites and "roving techniques" at other sites.

In 2023, out of the 47 coral species present on the study sites, 44 were affected by bleaching, corresponding to 93% of the species. Among the 6053 colonies examined, 68% showed signs of bleaching to a greater or lesser extent. In December 2023, when the sea temperature had fallen below 29°C, coral mortality concerned 4% of the colonies, except for the three species of *Acropora* affected by massive mortality. Statistical analyses showed that the extent of bleaching did not present significant differences between the Caribbean and Atlantic coasts and the bay of Grand Cul-de-Sac Marin in the north of the island. Similarly, between the surface and 20m depth, the extent of bleaching appeared to be evenly distributed. This last phenomenon was certainly related to the fact that the water temperature warming affected this entire bathymetric range and even beyond since bleached corals had been observed at a depth of more than 50m.

During 2024, the rate of colonies showing signs of bleaching averaged 20%, with very wide differences depending on the species' sensitivity. It is impossible to distinguish among these corals those that have still not recovered their algae following the 2023 episode of those that would have recently bleached when the sea temperature exceeded 29°C again in May-June 2024. From January 2024, delayed coral mortality has developed globally, reaching 66% of the corals bleached in 2023, and an average of 30% of the coral colonies died. Such a phenomenon of delayed mortality is classic after an episode of bleaching. It has a noticeable impact on the reef's living coral cover. This rate fluctuated according to reef sites, where bottom coral coverage dropped between 20% and 55% in September 2024. The coral cover of a reef is an important functional parameter for the ecosystem. Its fall is not directly correlated with the number of corals dying but also the size of the disappeared colonies.

The bleaching phenomenon did not affect coral recruitment in December 2023. However, juvenile corals observed during this period were all bleached. In 2024, the recruitment of juvenile corals drastically dropped.

Bleaching also affected other symbiotic organisms (Gorgonians, Zoantharians, Actinarians, Corallimorpharians). The absence of skeletons in these animals or their fragility (Gorgonians) makes it difficult to estimate the mortality induced by the bleaching phenomenon.

Reef fish communities did not present noticeable changes in biodiversity, fish abundance, and structural organization. Nevertheless, a drop in juvenile recruitment occurred in 2023, a phenomenon attributed more to the significant rise in water temperature that year than to coral bleaching (Waldock *et al.*, 2019; Foo *et al.*, 2024).

In conclusion, the coral bleaching event that impacted the reefs of Guadeloupe Island in 2023, along with the subsequent coral mortality observed in 2024, highlights the most significant bleaching threat since 2005 (Bouchon *et al.*, 2008; Eakin *et al.*, 2010). Addressing the long-term implications of these events on reef ecosystems necessitates further research and targeted conservation efforts to protect Caribbean coral species facing unprecedented thermal stress challenges.

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