

# Long-term Trajectory of the Threatened Coral *Acropora palmata* in San Andres Island, Seaflower Marine Protected Area

## Trayectoria a Largo Plazo del Coral Amenazado *Acropora palmata* en la Isla de San Andres, Área Marina Protegida Seaflower

## Trajectoire à Long Terme du Corail Menacé *Acropora palmata* sur L'île de San Andres, Zone Marine Protégée Seaflower

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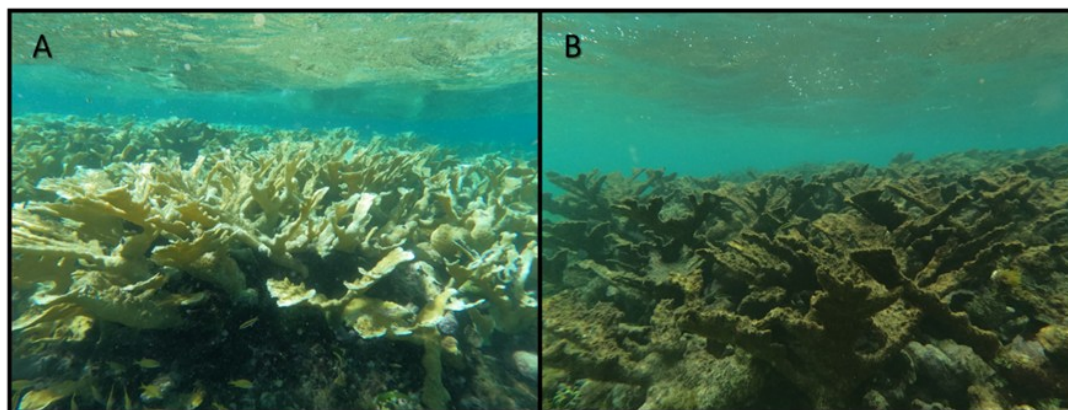
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### EXTENDED ABSTRACT

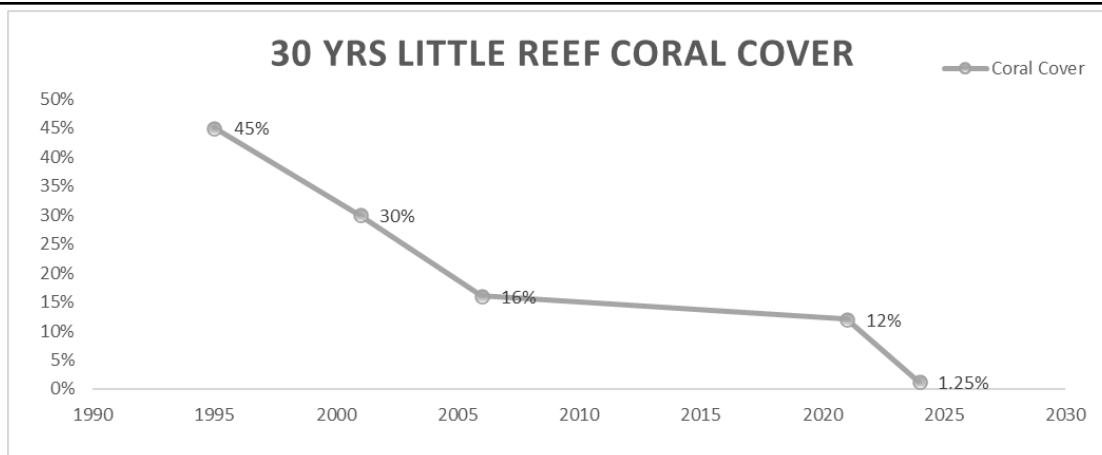
San Andres is an oceanic island in the Western Caribbean, and economic center of the Archipelago of San Andres, Providence, and Santa Catalina, Colombia, Seaflower Biosphere Reserve (BR) (UNESCO, 2000). The BR protects 65,000 km<sup>2</sup> of marine territory through the Seaflower Marine Protected Area (MPA), with San Andres in the southern section. It is a 27 km<sup>2</sup> coral island with a 7 km<sup>2</sup> semi-circular barrier reef, with fringing, patch, and lagoon reefs. Like other shallow reefs in the Caribbean, the condition of San Andres reefs has declined over the past fifty years. Previously dominant species such as the elkhorn coral (*Acropora palmata*) are now threatened, and reef communities have shifted. Coral reefs' long-term monitoring within the MPAs provide critical data on the effects of natural and anthropogenic stressors, and the effectiveness of conservation measures taking place within these areas. To date, it is uncertain whether the observed benefits of MPAs are sufficient to offset coral losses from major disease outbreaks and bleaching events, both of which are predicted to increase with climate change. To better understand these dynamics, *A. palmata* population trends over time were evaluated within the Seaflower MPA in San Andres Island. Long-term monitoring (1992 to 2024) revealed significant population declines, high impacts were recorded after hurricanes ETA and IOTA, with mass mortality following bleaching events in 2023. Our results suggest that MPAs alone may not be enough to mitigate thermal stress causing bleaching, hence not achieving conservation goals. This information is important for future management and conservation of coral reefs.

### INTRODUCTION

The coral *Acropora palmata* plays an essential role in Caribbean reef ecosystems by providing complex habitat structures that support high biodiversity and protect coastlines from storms. Despite its importance, *A. palmata* populations have faced severe declines due to climate change-induced bleaching, disease outbreaks, and physical damage from hurricanes. San Andres Island, located in Colombia's Seaflower Marine Protected Area (MPA), serves as a critical monitoring site for assessing *A. palmata*'s long-term trends under protective management. This extended abstract presents findings from a study tracking *A. palmata*'s population trajectory at Little Reef within the Seaflower MPA from 1992 to 2024.



**Figure 1.** Little Reef: *Acropora palmata* secondary barrier reef in San Andres Island. Pictures of *A. palmata* in A) October 2023 before coral bleaching event and B) May 2024 after mass mortality event.



**Figure 2.** Changes in coral cover in Little Reef secondary barrier reef in San Andres Island through the last 30 years of monitoring showing 1995, 2002, 2006, 2021 and 2024.

### OBJECTIVES AND METHODS

The objective of this study was to evaluate population trends of *Acropora palmata* populations over time within San Andres Island, particularly monitoring benthic cover at Little Reef from 1992-2024 using point-intercept transects and photographic quadrat surveys. This study utilized statistical analyses (including Kendall's Tau) to assess trends in coral cover and correlate population declines with bleaching events and hurricanes.

### RESULTS AND DISCUSSION

Our findings reveal a significant decline in *A. palmata* cover from 45% in 1992 to just 1.25% in 2024. Notable declines followed hurricanes ETA and IOTA in 2020, with an additional 11% drop due to the 2023 bleaching event, underscoring the susceptibility of *A. palmata* to thermal stress (Figures 1 and 2). These results indicate that, despite the protections of the Seaflower MPA, passive conservation measures alone are insufficient to counter the broad-scale impacts of climate change. The observed decline at Little Reef mirrors trends seen in other Caribbean MPAs, such as the Exuma Cays Land and Sea Park (Bahamas) and Hol Chan Marine Reserve (Belize), where *A. palmata* and other coral species continue to decline due to climate-driven stressors.

These findings highlight the urgent need to mitigate local stressors, including unsustainable fishing practices, marine pollution, and coastal development, which further compromise reef resilience. Addressing these local pressures alongside climate resilience measures is essential to enhance the protective effects of the Seaflower MPA and improve conditions for coral recovery. Integrating these actions with active restoration approaches, as recommended by Rinkevich (2008), is crucial to enhance the conservation effectiveness of MPAs like Seaflower.

### CONCLUSIONS AND RECOMMENDATIONS

The precipitous decline of *A. palmata* within the Seaflower MPA calls for a shift from passive to active management. To preserve remaining populations, we recommend implementing coral nurseries, selective breeding

for resilience, and adaptive management that responds to climate-induced events. Strengthening regional MPA networks and advancing global climate policies will also be crucial to support the long-term survival of Caribbean coral species. These findings provide valuable insights for coral conservation efforts in the face of intensifying climate threats.

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.

### LITERATURE CITED

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