Shifts in dominance of benthic communities along a gradient of water temperature and turbidity in tropical coastal ecosystems

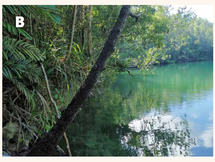

Figure 1. (A) Aerial view and (B) ground-level view of marine lake

INTRODUCTION

With rising global seawater temperatures and local anthropogenic impacts, it becomes increasingly important to understand how benthic coastal communities may shift.

For this purpose, we sampled benthic communities in coastal coral reef locations as well as in marine lakes with a range in water temperatures and turbidity.

METHOD

In total, 46 reefs (depth 5m and 10m) and 11 marine lakes were surveyed from Raja Ampat, Indonesia, between 2018 and 2020. Benthic communities were assessed using a photo quadrat transect method. Photos were analyzed using the Coral Point Count with Excel extensions (CPCe) program to estimate the coverage of the different benthic organisms.

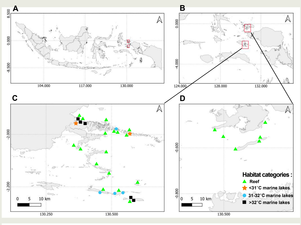

Figure 2. Sampling sites: (A) Indonesia, (B) two geographic regions surveyed in Raja Ampat (C), Misool, and (D) Dampier Strait

RESULT

The biodiversity of benthic communities decreased with increased seawater temperatures and turbidity. We found a clear decrease in biodiversity as water temperature increased, which may have implications for ecosystem functioning. Our results suggest that beyond a certain temperature (>31 °C), benthic communities shift away from coral dominance, with a shift from coral-algae dominated systems to those dominated by macro-algae, benthic cyanobacterial mats, filter feeders, sponges, or a combination of these groups.

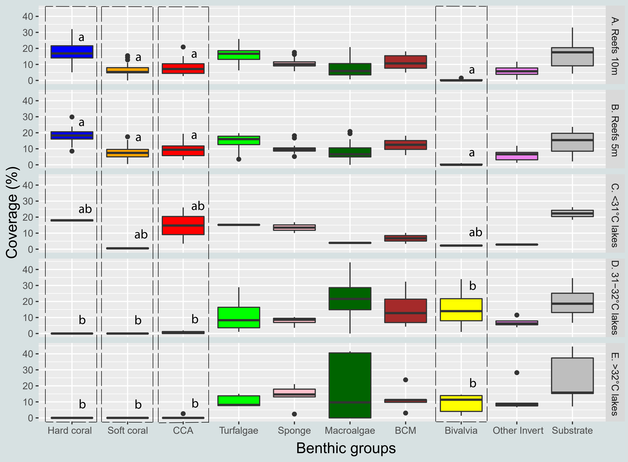

Figure 3. The coverage of major benthic groups from each habitat category. Different letters on Hard coral, Soft coral, CCA, and Bivalvia indicate significant differences across habitats (vertical line). Note: CCA, Crustose Coralline Algae; BCM, Benthic Cyanobacterial Mats.

CONCLUSION

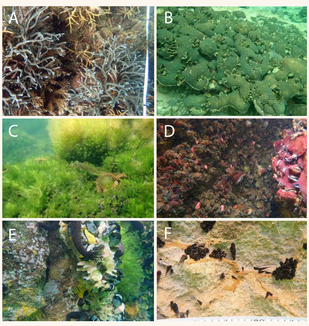

Figure 4. Representative of benthic appearance from (A) Reef with branching Acropora, (B) <31 °C marine lake with massive coral, (C and D) 31-32 °C marine lake, and (E and F) >32 °C marine lake.

While marine lakes do not directly translate to coastal reef systems, they can provide insights into the interactions of major benthic groups under variable environmental conditions and the bottom-up processes that could lead to shifts in dominance within tropical coastal marine ecosystems when hard corals are no longer dominant.

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