Patterns & Drivers of Reef Resilience at Aldabra Atoll, Seychelles

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Background and Objectives

The 2014-2017 global bleaching event caused mass mortality of corals worldwide, affecting also protected and remote reefs[1]. This challenges the common notion that reefs far removed from local human impacts are more resilient to climate change[2]. To better understand resilience of remote reefs, we study the susceptibility to, and recovery since, the 2016 coral bleaching event at Aldabra Atoll, a UNESCO World Heritage Site in the Seychelles.

In this study we

- Assess bleaching susceptibility by analysing the difference in pre- and post-bleaching benthic community composition.
- Assess early recovery by analysing the trajectory in benthic community composition as well as coral juvenile and larvae settlement densities after the bleaching event

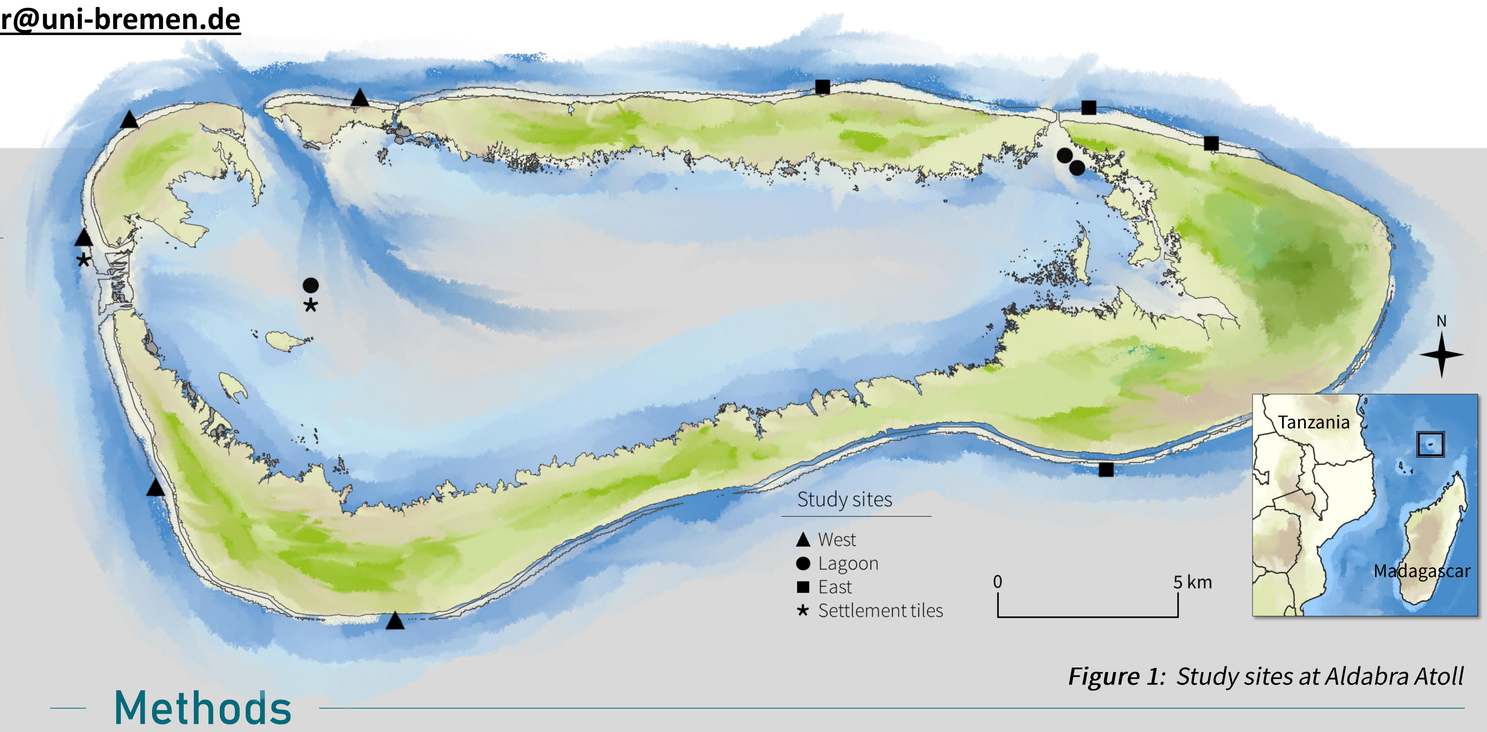


***Figure 1:** Study sites at Aldabra Atoll*

Methods

- Benthic community composition: Benthic photoquadrats collected before (Dec 2015) and after the bleaching event (Dec 2016, 2017, 2018) on 12 sites (**Fig. 1 & 4**)
- Coral juveniles: Quadrat counts in Dec 2016 and Dec 2018 on the 12 sites
- Coral recruitment : settlement tiles replaced every 2 months since Aug 2018 on 2 sites (**Fig 1 & 5**)
- Statistics (R): Generalized Linear Mixed Models (GLMM) and Generalized Estimating Equations (GEE)

***Figure 2:** Bleached reef January 2016*

***Figure 3:** Recovering reef July 2018*

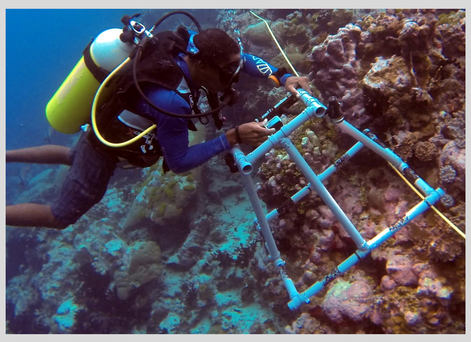


***Figure 4:** Benthic photoquadrat survey*

***Figure 5:** Coral larvae settlement tile*

Results

Susceptibility

- Mean hard coral cover decreased across all areas between Dec 2015 and Dec 2016 by >55% in the east and west and by 35% inside the lagoon (GEE, dF= 1, χ^2= 24.9, p <0.001) (**Fig. 6**)

Recovery

- Mean hard coral cover increased in all areas between 2016 and 2018 (GLMM, dF= 2, χ^2= 6.57, p <0.05) (**Fig. 6**)
- By Dec 2018, mean hard coral cover reached 50% of the pre-bleaching cover in the east and west and 88% inside the lagoon (**Fig. 6**)
- Between 2016 and 2018, the density of juvenile corals increased substantially in the west and inside the lagoon (GLMM, dF= 2, χ^2= 26.58, p <0.001) (**Fig. 7a**)
- Settlement of coral larvae was higher inside the lagoon than on the outer reef (**Fig. 7b**)

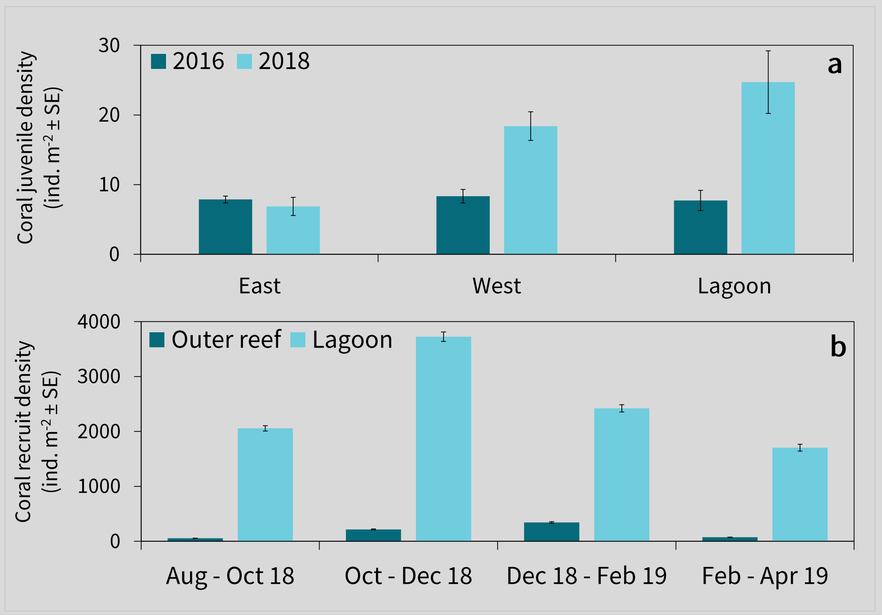


***Figure 7:** **a.** Density of coral juveniles in 2016 and 2018; **b.** density of coral recruits on settlement tiles in lagoon and on outer reef (see Fig 1)*

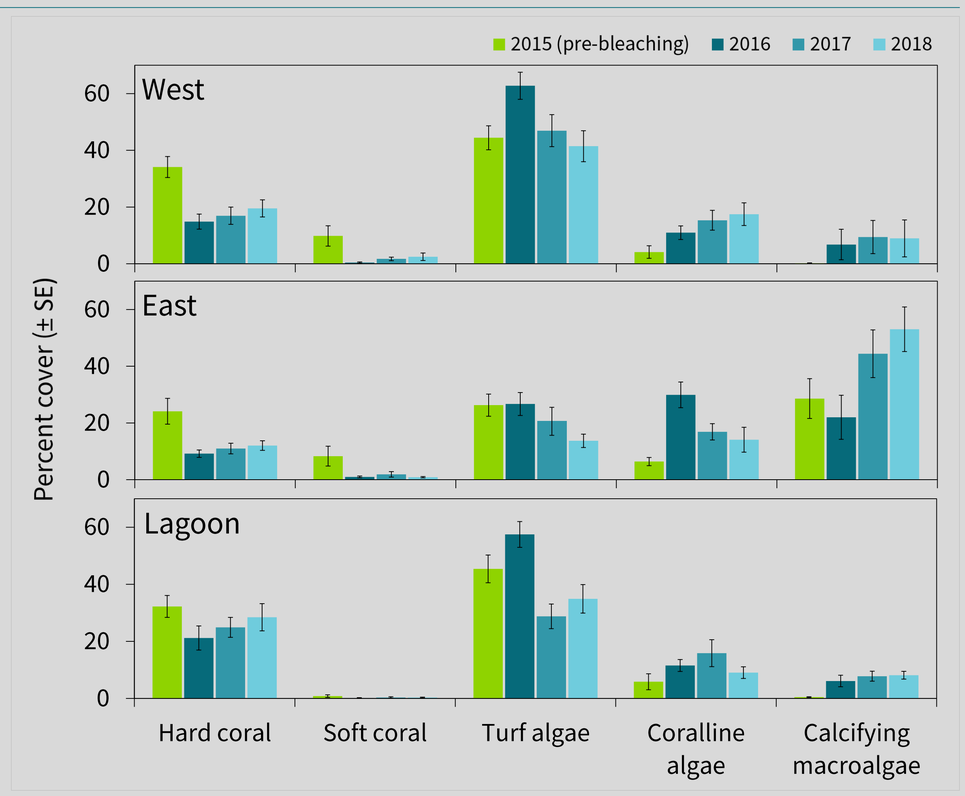
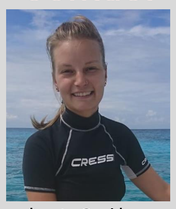


***Figure 6:** Cover of major benthic categories before (2015) and after the bleaching event (2016, 2017, 2018).*

Conclusion

- The 2016 bleaching event caused loss of coral across Aldabra.
- The higher amount of post-bleaching coral cover inside the lagoon suggests increased heat stress tolerance of lagoon corals, presumably due to higher daily fluctuations of water temperatures.
- Post-bleaching increase in coral cover and juvenile density indicates high recovery potential of Aldabra's western and lagoon reefs.
- Mean recruit densities in lagoon between Oct-Dec 18 exceeded the max. densities recorded during similar study in Kenya (3244 ind. m^{-2}), where tiles were deployed for three months[3] (two months in this study)
- Further analysis is needed to understand changes in benthic community composition and patterns of coral recruitment.
- Our results contribute to understanding the natural drivers of coral reef resilience, aiding in the identification of priority areas for conservation.

Contact



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References

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2. Hughes et al. Nature 2017, 543, 373-377
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