



Modeling the effects of fish excretions on coral growth and bleaching

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1. Introduction

Background: Coral bleaching, which results from the breakdown of the symbiosis between corals and their algal symbionts, is a major threat to coral reefs^[1]. Nutrients excreted by coral-dwelling fishes can increase coral growth rates^[2] and could potentially affect corals' risk of bleaching.



Results (cont.)

3.2

Results (cont.)

Fish can inhibit recovery from bleaching in 3.4 low flow, high nitrogen environments and when the abundance of coral prey is low

Question: How does nutrient excretion by coral-dwelling fishes affect the bleaching response of host corals?

Methods: A dynamic energy budget model of the coral-algal symbiosis^[3] was modified to include coral-dwelling fish. Model additions were parameterized using MCR LTER data.

2. Diagram of the model



predicts a "Goldilocks" effect of nitrogen

For corals experiencing light stress, the model







3. Results

In the absence of light stress, fish excretions can 3.1 enhance coral growth. This positive effect is greatest in low-flow, low-nitrogen environments

Detmer et al. 2022^[4]

The model predicts fish excretions can 3.3 reduce corals' tolerance of light stress



Detmer et al. 2022^[4]

4. Conclusions

• Model predicts the effects of fish excretions on corals are dependent on environmental conditions

• Fish can enhance coral growth, but may also exacerbate bleaching under stressful conditions

• Empirical tests of model predictions and assumptions should lead to a more mechanistic understanding of how coral-dwelling fishes affect coral bleaching

References



^[1] Hughes et al. 2018 *Science* 359(6371): 80-83

^[2] Holbrook et al. 2008 *Mar. Biol.* 155(5): 521-530

^[3]Cunning et al. 2017 *JTB* 431: 49-62

^[4] Detmer et al. 2022 *JTB* 541: 111087

Acknowledgements

We thank Sally Holbrook, Deron Burkepile, Peter Edmunds, and the E5 Coral Research team for providing data used in model parameterizations. We thank the E5 Modeling Group and the Moeller Lab for helpful discussions and feedback.