

Drivers of coral diversity and disease occurrence in the Florida Keys

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Background

- Stony coral diseases such as stony coral tissue loss disease (SCTLD) and white plague cause significant amounts of mortality in the Caribbean and Gulf of Mexico^[1,2].
- We investigated how natural and anthropogenic drivers affect coral status and spread of stony coral diseases in the Florida Keys.

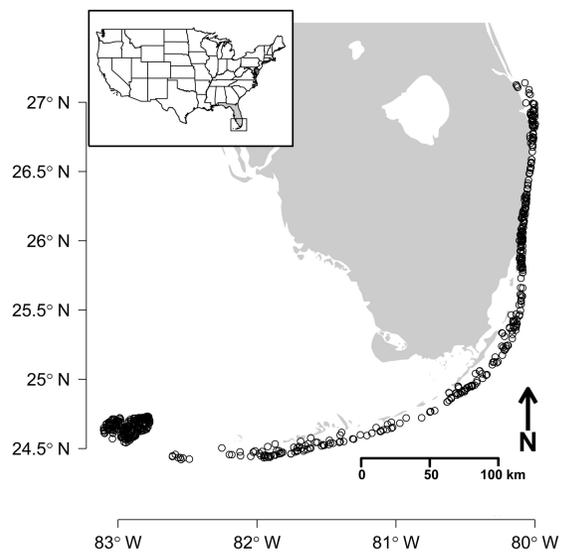


Figure 1. Coral sampling locations along the Florida Keys.

Results and Discussion

Coral and disease status

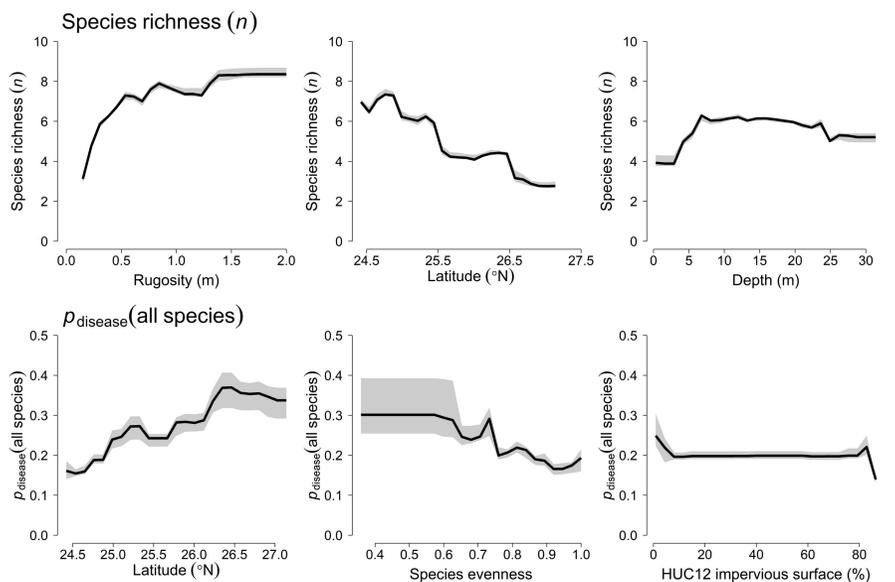


Figure 2. BRT models explained 68.7% of deviance in species richness (top) and 24.6% of deviance in disease occurrence (bottom row). Predictions and 95% CI for 3 most influential predictors are shown here. Area under the curve (AUC) for the final disease occurrence model was 0.87.

Variable importance

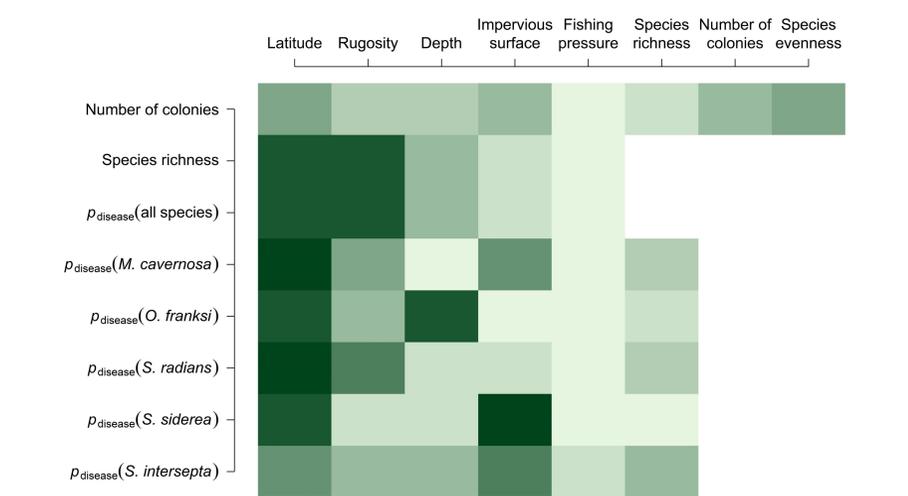


Figure 4. Relative importance of predictors (columns) for each response variable (rows). Darker colors indicate greater importance; white indicates a variable was not included.

Methods

- Integrated data from NOAA National Coral Reef Monitoring Program^[3] with human population^[4], land cover^[5], and geographical characteristics^[6].
- Boosted regression trees^[7] used to model coral status and disease prevalence.
- Models force-fit to include fishing and impervious surface, two key anthropogenic risk factors.

Predictor correlations

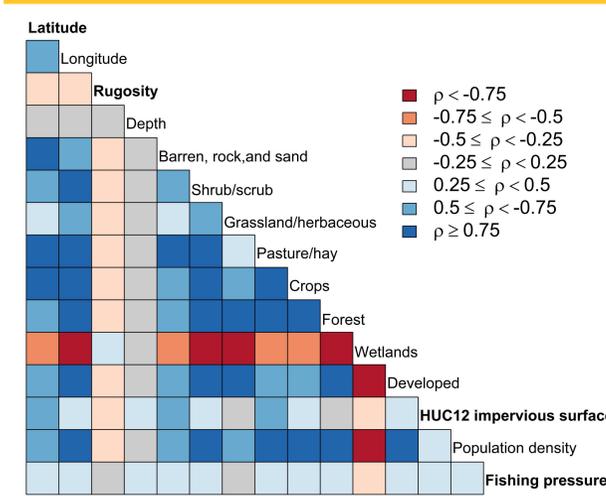


Figure 3. Rank correlations (Spearman's ρ) between predictor variables. Variables in boldface were used in the final analysis.

Conclusions

- Coral community status and disease occurrence driven by mostly by natural factors
- Fishing not influential for disease occurrence; impervious surface important for some taxa.
- More precise data needed to identify terrestrial risk factors of stony coral diseases.

References

^[1] Muller EM, Sartor C, Alcaraz NI, van Woesik R. 2020. Spatial epidemiology of the stony-coral-tissue-loss disease in Florida. *Frontiers in Marine Science* 7. DOI: <https://doi.org/10.3389/fmars.2020.00163>.
^[2] Rosales SM, Clark AS, Huebner LK, Ruzicka RR, Muller EM. 2020. *Rhodobacterales* and *Rhizobiales* are associated with stony coral tissue loss disease and its suspected sources of transmission. *Frontiers in Microbiology* 11. DOI: <https://doi.org/10.3389/fmicb.2020.00681>.
^[3] NOAA. 2018. National Coral Reef Monitoring Program: assessment of coral reef benthic communities in the Florida Reef Tract. NOAA National Centers for Environmental Information. URL: <https://doi.org/10.7289/v5xw4h4z>.
^[4] WorldPop. URL: www.worldpop.org (accessed 2021-03-21)
^[5] National Land Cover Database. URL: <https://www.mrlc.gov/data/nlcd-land-cover-conus-all-years> (accessed 2021-03-21)
^[6] NHDPlus HR. National Hydrography Dataset. URL: <https://www.usgs.gov/core-science-systems/ngp/national-hydrography/nhdplus-high-resolution> (accessed 2021-03-21)
^[7] Elith J, Leathwick JR, Hastie T. 2008. A working guide to boosted regression trees. *Journal of Animal Ecology* 77: 802-813. DOI: <https://doi.org/10.1111/j.1365-2656.2008.01390.x>