

Ecological results of SCTLD multi-species transmission experiment at the University of the Virgin Islands Center for Marine and Environmental Studies

Website: <https://www.bco-dmo.org/dataset/875156>

Data Type: experimental

Version: 1

Version Date: 2022-07-20

Project

» [RAPID: Collaborative Research: Predicting the Spread of Multi-Species Coral Disease Using Species Immune Traits](#) (Multi-Species Coral Disease)

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Abstract

This dataset represents the ecological results of a stony coral tissue loss disease (SCTLD) multi-species transmission experiment. Eight colonies of six species of corals (*Colpophyllia natans*, *Montastraea cavernosa*, *Orbicella annularis*, *Porites astreoides*, *Pseudodiploria strigosa*, and *Siderastrea siderea*) were split in half and one half of these fragments were simultaneously exposed to SCTLD-affected colonies of *Diploria labyrinthiformis* and the other half were exposed to healthy colonies of *D. labyrinthiformis*. All corals were monitored for lesion appearance over an eight day experimental period. No lesions were recorded on healthy-exposed corals. Numbers of fragments showing lesion appearance, time to lesion appearance, and expansion rates of lesions for SCTLD-exposed corals are reported here.

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Coverage

Spatial Extent: N:18.3276666667 E:-64.9259722222 S:18.3174722222 W:-64.9908333333
Temporal Extent: 2019-03-22 - 2019-04-10

Methods & Sampling

In summary, eight colonies each of healthy *Colophyllia natans*, *Montastraea cavernosa*, *Orbicella annularis*, *Porites astreoides*, *Pseudodiploria strigosa*, and *Siderastrea siderea* were collected from the field where no disease was reported and brought to the University of the Virgin Islands marine laboratory and kept in running seawater tables. Colonies were split into two and allowed to acclimate to seawater table conditions. One day prior to the experiment commencing, eight healthy colonies of *Diploria labyrinthiformis* were collected from the same site. Separately, an additional 8 colonies of *D. labyrinthiformis* exhibiting signs consistent with stony coral tissue loss disease (SCTLD) were collected from a known diseased location and kept separate from healthy colonies. On the day the experiment commenced, fragments of the six coral species were arranged at equal distances around a healthy *D. labyrinthiformis*. For the disease treatment, corresponding fragments of each genet of the six species were arranged around a SCTLD-affected *D. labyrinthiformis*. Water changes were performed each day and all corals were checked twice daily for the appearance of lesions. When lesions appeared on a colony it was monitored more frequently and if lesions were determined to be consistent with SCTLD and expanding over a 12-hour period, the fragment was photographed, removed from the experimental container, and processed.

Methods and data analysis are published in Meiling et al. 2021 (doi: [10.3389/fmars.2021.670829](https://doi.org/10.3389/fmars.2021.670829)).

Data Processing Description

Data Processing:

Photographs of diseased corals were analyzed for lesion expansion rates using the program ImageJ (NIH).

BCO-DMO Processing description:

- Adjusted field/parameter names to comply with BCO-DMO naming conventions
- Added a conventional header with dataset name, PI names, version date
- Changed species name from *Colophyllia natans* to *Colpophyllia natans* (misspelling)

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Data Files

File
transmission_lesion.csv (Comma Separated Values (.csv), 3.18 KB) MD5:9948a42fc05f2029fc289a9c9c61fc15 Primary data file for dataset ID 875156

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Related Publications

Meiling, S. S., Muller, E. M., Lasseigne, D., Rossin, A., Veglia, A. J., MacKnight, N., Dimos, B., Huntley, N., Correa, A. M. S., Smith, T. B., Holstein, D. M., Mydlarz, L. D., Apprill, A., & Brandt, M. E. (2021). Variable Species Responses to Experimental Stony Coral Tissue Loss Disease (SCTLD) Exposure. *Frontiers in Marine Science*, 8. <https://doi.org/10.3389/fmars.2021.670829>

Results

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Parameters

Parameter	Description	Units
Species	Species name	unitless
Replicate	Replicate/Bin #	unitless
End_infection_status	Status of infection at the end of the experiment	unitless
Days_to_infection	Number of days to infection	unitless
Change_in_time	Change in time	hours
Change_in_area_of_lesion	Change in area of lesion	centimeters squared (cm ²)
Lesion_expansion_rate_hour	Expansion rate of lesions per hour	centimeters squared per hour (cm ² per hr)
Lesion_expansion_rate_minute	Expansion rate of lesions per minute	centimeters squared per minute (cm ² per min)
Colony_size	Size of colony	centimeters squared (cm ²)
Percent_lesion_expansion_rate	Expansion rate of lesion	percent per minute (%/min)

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Project Information

RAPID: Collaborative Research: Predicting the Spread of Multi-Species Coral Disease Using Species Immune Traits (Multi-Species Coral Disease)

Coverage: St. Thomas, U.S. Virgin Islands

NSF Award Abstract:

Coral reef ecosystems provide substantial economic resources to the societies of the United States Virgin Islands (USVI) and other US locations in the forms of tourism, fishing and coastal protection. However, reefs are among the most threatened marine environments, and coral disease is having a devastating impact on

these valued systems. In early 2019, a multi-species rapid tissue loss disease matching the description of stony coral tissue loss disease (SCTLD) was found severely affecting a reef off the southwest coast of St. Thomas in the US Virgin Islands (USVI). SCTLD has been devastating coral reef communities in southeast Florida for the last four years, and was very recently reported from disparate areas around the Caribbean, including Mexico, Jamaica, and St. Martin. Rapid surveys by the investigators at the University of the Virgin Islands believe that a 50 km² area southwest of St. Thomas is the initial incidence area of the disease, but will likely spread across the USVI, British Virgin Islands, and Puerto Rico. This study performs experiments to understand how this disease affects coral species immune traits and compares the microbiology and physiology of disease samples in the USVI to samples from Florida. It also examines how changing the species composition of a coral community affects the spread and impact of the disease. The overall aim is to produce a model to predict the impact of multi-species disease spread on reefs based on coral species assemblages. The project contributes to the research training of at least 2 undergraduates, 2 M.S. students, and 3 Ph.D. students, who benefit from cross-investigator mentoring. The research team includes representatives to the Coral Disease Advisory Committees for the USVI and Florida, which ensures rapid communication of findings to management bodies in both regions.

Coral disease is a significant and increasing threat to Caribbean coral reef systems. Recent results demonstrate that coral species immune traits can predict disease resistance, and thus, forecast impacts to coral community structure, under multi-species coral disease. The onset of this epizootic in the USVI offers an unprecedented opportunity to test hypotheses about the impact of coral resistance, tolerance and immune traits on disease spread during the early stages of an outbreak that could profoundly change the diversity of Caribbean reefs. It is hypothesized that the abundance of highly susceptible species dictates 1) the onset of disease at reef sites downstream of the initial incidence area, and 2) the spread of disease within reef sites. Furthermore, 3) downstream reef sites where highly susceptible species are removed or treated show lower immune responses in all susceptible corals, later onset of disease, and slower within-site disease spread. To test these hypotheses, two experiments directly compare species responses to disease exposure and test the effect of species assemblage on coral immune function and disease spread. Results from these experiments aim to inform a generalizable model to predict the impact of multi-species disease spread on reefs based on coral species assemblages. Results of this project include direct comparison of the USVI disease to Florida SCTLD and a better understanding of how the abundance of highly susceptible host species impacts the spread of disease during the early onset of a multi-species panzootic.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1928753
NSF Division of Ocean Sciences (NSF OCE)	OCE-1927277
NSF Division of Ocean Sciences (NSF OCE)	OCE-1928771
NSF Division of Ocean Sciences (NSF OCE)	OCE-1928817
NSF Division of Ocean Sciences (NSF OCE)	OCE-1928761
NSF Division of Ocean Sciences (NSF OCE)	OCE-1928609

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