

# Data describing every diseased coral record from surveys in the Caribbean during 2012 (Contagious coral diseases project)

**Website:** <https://www.bco-dmo.org/dataset/658275>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2016-09-06

## Project

» [Are coral diseases contagious?](#) (Contagious coral diseases?)

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## Abstract

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## Dataset Description

This dataset contains every diseased coral record from the surveys, including species, disease sign, site, and meter within site.

Coral disease transmission experiments were completed for dark-spot syndrome on *Sidereastrea siderea* and yellow-band disease on *Orbicella faveolata*, as described in Randall et al. 2016. Following experimentation, microbial communities were extracted from tissue samples to determine whether any potential pathogen may have transmitted from healthy to exposed corals. Microbial communities on healthy corals were compared with diseased corals to identify any potential pathogens.

Experimental diseased and healthy corals were sampled and their microbial communities were analyzed using 454 Illumina pyrosequencing of the amplified 16S rRNA gene on the V1-V3 hypervariable region.

## Acquisition Description

[Adapted from: Randall et al. 2014 Ecology 95(7) 1981-1994]

To assess the prevalence of coral diseases at each location, a survey area (1-10 km<sup>2</sup> depending on the region's geographic features) of hard-bottom habitat was visually defined using [Google Earth](#). The survey area was divided into 100 by 100 meter cells (using Google Earth Path 1.4.4). Within each location, twenty-five 100 by 100 meter cells were randomly selected as sites. These sites were defined as the primary sampling units. A single 10 by 10 meter quadrat was haphazardly placed within each site, for field-data collection. To maintain consistency across locations and to minimize potential effects of coral-assemblage differences, three criteria had to be met for a site to be surveyed: (1) the depth averaged between 5 and 10 meters, (2) the substrate was hard bottom, and (3) corals were present. If any one of these criteria was not met at a given site, it was rejected and the next randomly generated site was selected. In total, twenty-five, 10 by 10 meter quadrats were sampled at each location, for a total of 50 quadrats across two frequent-anomaly locations and 50 quadrats across two reference locations, for a total survey area of 10,000 m<sup>2</sup>.

All four locations were surveyed between 2 July and 1 September 2012. At each site, divers surveyed each 100 m<sup>2</sup> quadrat by systematically laying ten contiguous 1 x 10 m belt transects onto the reef substrate. Each coral colony with a disease sign was identified *in situ* and the species and disease signs were recorded. Four disease signs were identified: (1)

white sign was defined as a bright, white band or patch of recent mortality adjacent to healthy-appearing tissue (i.e., the tissue bordered a well-defined edge of exposed skeleton not yet colonized by algae or other biofouling organisms) (*sensu* Bythell et al. 2004), (2) dark spot was defined as tissue with purple, brown or black lesions, forming spots of irregular shapes (*sensu* Goreau et al. 1998), (3) black band was defined as a black band over the coral tissue exposing white skeleton with different stages of biofouling (*sensu* Richardson 2004), and (4) yellow sign was defined as a yellow discoloration of tissue forming a band or blotches (*sensu* Santavy et al. 1999). White signs and black bands were associated with recent tissue loss; yellow signs and dark spots were usually, but not always, associated with recent tissue loss. Notably, very few yellow bands were observed that followed the classical description (Reeves 1994). Instead, most coral colonies presented a patchy, non-uniform yellowing of the tissue; therefore the condition was termed 'yellow sign.' Additionally, any area of recently exposed white skeleton, which was not clearly caused by predation or a competitive interaction, was recorded as a white sign, including white plagues, white bands and white pox. The white-sign diseases were not differentiated because of similar- or identical-appearing signs, unknown etiologies for several diseases, and the possibility that the diseases were caused by the same pathogens (Bythell et al. 2004, Ainsworth et al. 2007). Coral colonies were occasionally recorded with two or more signs of disease, when those signs appeared to be spatially independent.

#### *Disease mapping:*

Four 100 m<sup>2</sup> quadrats per location were mapped in their entirety, for a total of eight 100 m<sup>2</sup> quadrats per temperature-stress level. Approximately 50 digital images were captured from each video-transect file using Free Video to JPG Converter v. 5.0.58 build 324. The digital images were stitched together using Adobe Photoshop CS5 v. 12.0, and ten 1–m by 10–m image mosaics were created for each 10 m by 10 m site. Each photo-mosaic was printed and, with the aid of the digital images and videos, the following data were measured and recorded for every coral colony within each site: (1) species, (2) spatial coordinates, (3) maximum diameter, (4) perpendicular diameter, (5) an estimate of percent partial mortality (0, <5, 25, 50, 75, or >95 %), and (6) 'health' status. Corals were identified as either healthy, or as having white signs, dark spots, black bands, yellow signs, or unknown signs of disease (as described above). Bleached or pale colonies also were recorded, and when multiple disease signs were present on an individual colony, both signs were recorded. Data from each site that was mapped are found in individual excel files in the folder called *Disease mapping site data files*.

## **Processing Description**

Only raw data, and data obtained from image mosaics are provided.

### **Data Management Office Notes:**

- Commas and spaces removed. Spaces were replaced with underscores.
- Reformatted column names to comply with BCO-DMO standards.

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### **Related Publications**

Ainsworth, T. D., Kramasky-Winter, E., Loya, Y., Hoegh-Guldberg, O., & Fine, M. (2006). Coral Disease Diagnostics: What's between a Plague and a Band? Applied and Environmental Microbiology, 73(3), 981–992. doi:[10.1128/AEM.02172-06](https://doi.org/10.1128/AEM.02172-06)

Bythell, J., Pantos, O., & Richardson, L. (2004). White Plague, White Band, and Other “White” Diseases. Coral Health and Disease, 351–365. doi:[10.1007/978-3-662-06414-6\\_20](https://doi.org/10.1007/978-3-662-06414-6_20)

Goreau T., Cervino J., Goreau M., Hayes R., Hayes M., Richardson L., Smith G., DeMeyer K., Nagelkerken I., Garzon-Ferrera J., Gil D., Garrison G., Williams E., Bunkley-Williams L., Quirolo C., Patterson K., Porter J., Porter K. (1998). Rapid spread of diseases in Caribbean coral reefs. Rev Biol Trop 46,157–171

Randall, C. J., Jordan-Garza, A. G., Muller, E. M., & van Woesik, R. (2014). Relationships between the history of thermal stress and the relative risk of diseases of Caribbean corals. Ecology, 95(7), 1981–1994. doi:[10.1890/13-0774.1](https://doi.org/10.1890/13-0774.1)

Randall, C. J., Jordán-Garza, A. G., Muller, E. M., & van Woesik, R. (2016). Does Dark-Spot Syndrome Experimentally Transmit among Caribbean Corals? PLOS ONE, 11(1), e0147493. doi:[10.1371/journal.pone.0147493](https://doi.org/10.1371/journal.pone.0147493)

Reeves L.(1994). Newly discovered: yellow band disease strikes keys reefs. Underwater USA. 1994;11:16.

Richardson, L. L. (2004). Black Band Disease. Coral Health and Disease, 325–336. doi:[10.1007/978-3-662-06414-6\\_18](https://doi.org/10.1007/978-3-662-06414-6_18)

Santavy, D. L., Peters, E. C., Quirolo, C., Porter, J. W., & Bianchi, C. N. (1999). Yellow-blotch disease outbreak on reefs of the San Blas Islands, Panama. Coral Reefs, 18(1), 97–97. doi:[10.1007/s003380050162](https://doi.org/10.1007/s003380050162)

## Parameters

Parameter	Description	Units
UIN	Individual coral ID number.	unitless
location	Location where coral was located.	unitless
reef	Reef where coral was located.	unitless
temp_level	Temperature stress level.	unitless
site_number	Site ID number.	unitless
meter	Meter along 10 meter transect.	unitless
genus	Genus of coral sampled.	unitless
species	Species of coral sampled.	unitless
sign_1	First disease sign identified.	unitless
sign_2	Second disease sign identified.	unitless
sign_3	Third disease sign identified.	unitless
sign_4	Fourth disease sign identified.	unitless
depth_max	Maximum depth of site.	meters

## Deployments

vanWoesik\_2012

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/562802">https://www.bco-dmo.org/deployment/562802</a>
<b>Platform</b>	Caribbean_nearshore
<b>Start Date</b>	2012-06-01
<b>End Date</b>	2016-05-31
<b>Description</b>	<p>First, we will use a hierarchical sampling design to test whether coral diseases follow a contagious-disease model over two spatial scales in the Caribbean. We will also undertake this study in locations with and without a recent history of frequent thermal stress to test the alternate hypothesis that coral diseases are not infectious and contagious but are instead the result of compromised coral hosts that have undergone thermal stress. Second, we will undertake transmission experiments to examine whether coral diseases are indeed transmissible. Study Locations: (1) Mahahual, Mexico (latitude 18°42'N, longitude 87°42'W) and (2) Tuxpan, Mexico (latitude 21°01'N, longitude 97°11'W), (3) Robet van (latitude 9°12'N, longitude 82°09'W), (4) St. John, United States Virgin Islands (USVI) (latitude 18°18'N, longitude 64°45'W), and (5) Wonderland Reef, Florida (latitude 24.56028 N, longitude 81.50127 W).</p> <p><b>Acquisition Description</b></p> <p>Caribbean Region, 4 locations (5-15 m depth): 1) Mahahual, Mexico; 18.7 N, 87.7 W 2) Tuxpan, Mexico; 21.0 to 21.5 N, 97.2 W 3) St. John, U.S. Virgin Islands; 18.3 N, 64.7 W 4) Bocas del Toro, Panama; 9.3 N, 82.2 W</p>

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## Project Information

**Are coral diseases contagious? (Contagious coral diseases?)**

**Coverage:** Caribbean

Diseases are one of the greatest threats to corals in the Caribbean. Yet, very little is known about marine diseases in general and coral diseases in particular. Although some pathogens have been acknowledged, identifying coral pathogens has proven difficult and evasive. Presently, coral diseases are assumed to be both infectious and contagious, suggesting that infection is caused by pathogens being passed from colony to colony through a vector. However, few studies have tested this assumption. Spatial epidemiology, or disease mapping, can provide insight into whether diseases cluster and follow a contagious-disease model. In this study we will take a two tiered approach. First, we will use a hierarchical sampling design to test whether coral diseases follow a contagious-disease model over two spatial scales in the Caribbean. We will also undertake this study in locations with and without a recent history of frequent thermal stress to test the alternate hypothesis that coral diseases are not infectious and contagious but are instead the result of compromised coral hosts that have undergone thermal stress. Second, we will undertake transmission experiments to examine whether coral diseases are indeed transmissible. The research will take place in the Caribbean, at four locations: (1) Mahahual, Mexico (latitude 18°42'N, longitude 87°42'W) and (2) Tuxpan, Mexico (latitude 21°01'N, longitude 97°11'W), (3) Bocas del Toro, Panama (latitude 9°12'N, longitude 82°09'W) and (4) St. John, United States Virgin Islands (USVI) (latitude 18°18'N, longitude 64°45'W). Intellectual merit There is a certain urgency to identify coral diseases, predict their prevalence, and determine whether they are infectious and contagious or non-communicable. By understanding the etiology of coral diseases, we can determine whether human intervention will help reduce their prevalence. Without understanding these processes, we will merely continue to measure disease, continue to look for pathogens that may not exist, and watch coral populations continue to deteriorate. Although microbes play a role in disease infection, many coral diseases might not be transmissible. Therefore, we may need to incorporate environmental threshold parameters, which may be more likely the underlying mechanisms driving coral-disease dynamics. The results will have important implications for modeling diseases and predicting contemporary and future coral disease outbreaks. Broader Impact The underlying assumption of most disease models is contagion, which is the transmission of pathogens from infected to susceptible hosts. This study will examine this basic assumption. If it turns out that coral diseases are a consequence of a two-step process, and the corals that are tolerant to temperature stress are also resistant to diseases, then making predictions based on temperature trends will be transformational, especially in rapidly warming, yet heterogeneous, oceans. The study will train students in the field of spatial epidemiology of coral diseases.

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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-1219804</a>

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