

# Results from an experiment investigating the interaction between simulated grazing and fungal disease incidence in mangroves on Abaco Island, Bahamas from 2014-2016 (Mangrove Die-off project)

**Website:** <https://www.bco-dmo.org/dataset/665001>

**Data Type:** experimental

**Version:** 1

**Version Date:** 2016-11-16

## Project

» [An interdisciplinary approach to elucidating the causes of widespread mangrove die-off](#) (Mangrove Die-off)

| Contributors                  | Affiliation   | Role                        |
|-------------------------------|---|-----------------------------|
| <a href="#">Layman, Craig</a> | North Carolina State University (NCSU)              | Lead Principal Investigator |
| <a href="#">Rossi, Ryann</a>  | North Carolina State University (NCSU)              | Student, Contact            |
| <a href="#">Ake, Hannah</a>   | Woods Hole Oceanographic Institution (WHOI BCO-DMO) | BCO-DMO Data Manager        |

## Abstract

Results from an experiment investigating the interaction between simulated grazing and fungal disease incidence in mangroves on Abaco Island, Bahamas from 2014-2016 (Mangrove Die-off project)

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## Coverage

**Temporal Extent:** 2015-06-26 - 2015-07-23

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## Dataset Description

Data investigating the interaction between simulated grazing and fungal disease incidence.

## Methods & Sampling

Count data was collected by the same 2 persons for each parameter throughout the experiment. Areas were measured using Image J software. This study was conducted on Abaco Island in the Bahamas from 2014-2016.

## Data Processing Description

This data has been analyzed using a split plot ANOVA in R.

### BCO-DMO Data Processing Notes:

- Replaced site codes with their full names
- Reformatted column names to comply with BCO-DMO standards
- Replaced spaces with underscores
- Changed significant figures to reflect the accuracy of the measuring system

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## Data Files

| File  |
|---|
| <b>grazing.csv</b> (Comma Separated Values (.csv), 84.15 KB)<br>MD5:4145b2a933aa9226a142b4a24b85674e<br>Primary data file for dataset ID 665001 |

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## Parameters

| Parameter         | Description   | Units               |
|-------------------|---|---------------------|
| site              | The sample location   | unitless            |
| leaf_pair         | Number identifying leaves that were cut and uncut                         | count               |
| type              | Treatment of simulating grazing (Cut) or control (Uncut)                  | unitless            |
| lesion_num        | Count of lesions on each leaf within each leaf pair                       | count               |
| lesion_area       | Area of lesion covering leaf surface                                      | millimeters squared |
| leaf_area         | Area of leaf  | millimeters squared |
| lesion_proportion | Proportion of leaf covered by lesion; area of lesion divided by leaf area | unitless            |
| lat               | latitude  | decimal degrees     |
| lon               | longitude   | decimal degrees     |

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## Deployments

### Layman\_2014

|                   |   |
|-------------------|---|
| <b>Website</b>    | <a href="https://www.bco-dmo.org/deployment/653913">https://www.bco-dmo.org/deployment/653913</a> |
| <b>Platform</b>   | shoreside Abaco_Island  |
| <b>Start Date</b> | 2014-05-01  |
| <b>End Date</b>   | 2016-04-30  |

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## Project Information

**An interdisciplinary approach to elucidating the causes of widespread mangrove die-off**

## (Mangrove Die-off)

**Coverage:** Abaco Island, The Bahamas

Foundation species are those that form the basis for entire ecosystems, substantially altering the physical and biological characteristics of the areas in which they are found. Mangroves are one of the most conspicuous groups of foundation species, providing numerous ecosystem services which we highly value, e.g., habitat for ecologically and economically important species, shoreline stabilization and carbon storage. As such, global declines in mangroves is of utmost concern. For example, an extensive die-off of dwarf red mangrove has been identified in a remote area on the west side of Abaco Island, The Bahamas. Because of its remote nature of the site, the die-off is unlikely to be directly due to human activities. Despite its largely inaccessible nature, the area is ecologically and economically important, e.g., it is the primary bonefishing area on Abaco - an industry worth more than \$150 million annually in The Bahamas. Therefore, it is of pressing concern for stakeholders in The Bahamas to identify the underlying cause(s) of decline and assess potential threat to mangroves in other areas. To do so, a series of activities will be carried out, including widespread surveys for a recently identified fungal pathogen, laboratory efforts to isolate and identify this pathogen, satellite imagery mapping activities, and simulated grazing experiments. The area in which the die-off is occurring is currently being considered for designation as a national park by the Bahamian National Trust (BNT). The results of the study will be directly communicated to the BNT and will be used to make immediate management decisions. In collaboration with two Bahamian environmental NGOs, Friends of the Environment and Bahamas Reef Environmental Education Foundation (BREEF), a citizen science-based survey for fungal lesions, as well as an educational module on mangrove ecology, will be designed. The data from the citizen-science and student surveys will be integrated in a map of the incidence of the lesions across The Bahamas. The citizen-science component, and interaction with bonefish guides, provides the opportunity to further integrate science and education. The educational module will be introduced at the BREEF summer teaching training workshop in July. This annual event typically includes 30 teachers from 10 islands. The investigators will continue to make all of our research findings immediately available and accessible to the public through the Abaco Scientist website (<http://appliedecology.cals.ncsu.edu/absci/>).

Provisioning of ecosystem services in the coastal realm is largely mediated by foundation species, such as mangroves, coral and salt marsh grasses. Many of these species are undergoing substantial declines throughout the world. These declines are often driven by complex, interacting, stressors that may be difficult to identify and elucidate. Despite the difficulty, unraveling such mechanistic drivers is essential for stemming declines and developing management strategies for these ecosystems. Mangroves provide many highly valued ecosystem services to coastal communities, yet worldwide these forests are rapidly declining. Much of this loss is related to various human activities along coastlines, but natural ecological mechanisms contribute to declines in many areas as well. An extensive die-off of dwarf red mangrove (*Rhizophora mangle*) was observed in a remote area on the west side of Abaco Island, The Bahamas. Preliminary observations suggest the die-off may be due to a combination of fungal pathogens, grazing, and physical stress. This combination of stressors is strikingly parallel to the drivers of salt marsh decline on the East and Gulf coasts of the U.S. To date, different fungal strains from mangrove leaves have been identified. One fungus is a species of *Pestalotiopsis*, an Ascomycete fungus, and members of this genus are known plant pathogens. There are also high densities of a nocturnally active herbivorous cricket (*Taillasca eleuthera*) in die-off areas. It is unclear whether this species has recently colonized the area, is increasing in density, or both. In addition, high salinities in the sediment porewater in the die-off area suggest another potential stressor for the plants. A series of observations and experimental studies will be used to examine potential mechanistic drivers of the mangrove die-off. First, the extent of the die-off areas will be mapped using aerial surveys conducted with a GPS-integrated drone equipped with a video camera. Progression of the die-off will be examined with historical spectral profiles of mangroves from 1980s-present (on an annual basis) using Landsat satellite data. Second, the incidence of lesions on mangroves across Abaco Island and throughout The Bahamas will be explored using a series of citizen science initiatives. Third, identification of fungi will require DNA sequencing and examination of the morphology of fungal spores/conidia at North Carolina State University. Fourth, maintenance of a grazer exclusion experiment near the die-off location will provide an assessment of the role of herbivory in this system. Finally, simulated grazing scar experiments will be used to assess if grazing can indeed facilitate fungal infections.

## Funding

| Funding Source   | Award                       |
|--|-----------------------------|
| <a href="#">NSF Division of Ocean Sciences (NSF OCE)</a> | <a href="#">OCE-1541637</a> |

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