

Benthic survey of Looe Key and Wonderland Reef conducted in 10-15 December 2023

Website: <https://www.bco-dmo.org/dataset/907661>

Data Type: Other Field Results

Version: 1

Version Date: 2024-05-02

Project

» [Collaborative Research: The Influence of Sponge Holobiont Metabolism on Coral Reef Dissolved Organic Matter and Reef Microorganisms](#) (Sponge Holobiont DOM)

Contributors	Affiliation	Role
Aprill, Amy	Woods Hole Oceanographic Institution (WHOI)	Co-Principal Investigator
Easson, Cole G.	Middle Tennessee State University	Co-Principal Investigator
Fiore, Cara L.	Appalachian State University	Co-Principal Investigator, Contact
Reigel, Alicia M.	Appalachian State University	Scientist
Bartley, Michaela M.	Appalachian State University	Student, Contact
Soenen, Karen	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

Abstract

The benthic survey of Looe Key and Wonderland Reef was conducted by using a 100 m transect underwater above the reef. Species were identified and recorded every 10 cm on the transect. This created a transect with 100 points, which was then converted into percent cover of benthic species. The data recorded from the transects was compiled and analyzed to determine which reef has a higher density of sponges, and which reef has a higher density of coral. Four of the five surveys were conducted in Looe Key, and one survey was conducted in Wonderland Reef. Each survey included three separate transects. Wonderland Reef has about twice the percent cover of sponges (~31%), while Looe Key Reef has ~15.6% sponge cover. The percent cover of stony corals, octocorals, and hard substrate were similar at the two sites whilst Looe Key maintained a higher cover of palythoa (an invasive zoanthid) than Wonderland Reef.

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Coverage

Spatial Extent: N:24.562 E:-81.4087 S:24.5584 W:-81.5035

Temporal Extent: 2020-12-10 - 2020-12-15

Methods & Sampling

The benthic survey of Looe Key and Wonderland Reef was conducted by using a 100 m transect underwater

above the reef. Species were identified and recorded every 10 cm on the transect. This created a transect with 100 points, which was then converted into percent cover of benthic species. Each survey included three separate transects and five total surveys were conducted. Four surveys were conducted in Looe Key, and one survey was conducted in Wonderland Reef.

Issue: Uneven sampling of Wonderland Reef (n=1) and Looe Key (n=4).

Data Processing Description

The data recorded from the transects was compiled in excel to determine average percent cover for each group of organisms (i.e., sponges, stony corals, soft corals, Palythoa sp., substrate, algae).

BCO-DMO Processing Description

* Changed parameter names to comply with database requirements

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Data Files

File
907661_v1_benthic.csv (Comma Separated Values (.csv), 3.67 KB) MD5:8190440be6be89fd0ae4e9c863463645
Primary data file for dataset 907661

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Parameters

Parameter	Description	Units
Site	Reef location for the survey	Unitless
Date	Date of the survey in ISO format, local time zone	Unitless
Surveyors	Names of the people who conducted the benthic survey	Unitless
Latitude	latitude of the reef site	decimal
Longitude	longitude of the reef site	decimal
Octocoral_Briareum	Number of individuals within this genus or species of octocorals	individuals
Octocoral_Gorgonia_ventalina	Number of individuals within this genus or species of octocorals	individuals
Octocoral_Antillologorgia	Number of individuals within this genus or species of octocorals	individuals
Octocoral_Eunicea	Number of individuals within this genus or species of octocorals	individuals
Octocoral_Muricea	Number of individuals within this genus or species of octocorals	individuals
Octocoral_Plexaura	Number of individuals within this genus or species of octocorals	individuals

Octocoral_Pterogorgia	Number of individuals within this genus or species of octocorals	individuals
Total_Octocorals	Total number of octocorals recorded in that survey	individuals
Sponge_Xestospongia_muta	Number of individuals within this genus or species of sponges	individuals
Sponge_Aplysina_cauliformis	Number of individuals within this genus or species of sponges	individuals
Sponge_Aplysina_fulva	Number of individuals within this genus or species of sponges	individuals
Sponge_Callyspongia_armigera	Number of individuals within this genus or species of sponges	individuals
Sponge_Iotrochota_birotulata	Number of individuals within this genus or species of sponges	individuals
Sponge_Ptilocaulis_walparsi	Number of individuals within this genus or species of sponges	individuals
Sponge_Amphimedon_compressa	Number of individuals within this genus or species of sponges	individuals
Sponge_Chondrilla_caribensis	Number of individuals within this genus or species of sponges	individuals
Sponge_Clathria_spinosa	Number of individuals within this genus or species of sponges	individuals
Sponge_Ectyoplasia_ferox	Number of individuals within this genus or species of sponges	individuals
Sponge_Ircinia_felix	Number of individuals within this genus or species of sponges	individuals
Sponge_Mycale_laevis	Number of individuals within this genus or species of sponges	individuals
Sponge_Niphates_erecta	Number of individuals within this genus or species of sponges	individuals
Sponge_Scopalina_ruetzleri	Number of individuals within this genus or species of sponges	individuals
Sponge_Ircinia_strobilina	Number of individuals within this genus or species of sponges	individuals
Sponge_Cinachyrella_kuekenthalli	Number of individuals within this genus or species of sponges	individuals
Sponge_Agelas_clathrodes	Number of individuals within this genus or species of sponges	individuals
Sponge_Agelas_conifera	Number of individuals within this genus or species of sponges	individuals
Sponge_Agelas_wiedenmayeri	Number of individuals within this genus or species of sponges	individuals
Sponge_Aiolochoxia_crassa	Number of individuals within this genus or species of sponges	individuals
Sponge_Aplysina_archeri	Number of individuals within this genus or species of sponges	individuals
Sponge_Aplysina_fistularis	Number of individuals within this genus or species of sponges	individuals
Sponge_Smenospongia_conulosa	Number of individuals within this genus or species of sponges	individuals

Sponge_Verongula_rigida	Number of individuals within this genus or species of sponges	individuals
Sponge_Niphates_digitalis	Number of individuals within this genus or species of sponges	individuals
Sponge_Callyspongia_vaginalis	Number of individuals within this genus or species of sponges	individuals
Total_Sponges	Total number of sponges recorded in that survey	individuals
Stony_Coral_Millepora_sp	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Porites_porites	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Porites_astreoides	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Siderastea_radians	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Siderastrea_siderea	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Orbicella_faveolata	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Orbicella_annularis	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Madracis_mirabilis	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Meandrina_meandrites	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Stephanocoenia_intersepta	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Montastrea_cavernosa	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Diploria_labryinthiformis	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Diploia_strigosa	Number of individuals within this genus or species of stoney corals	individuals
Stony_Coral_Agaricia_agaricites	Number of individuals within this genus or species of stoney corals	individuals
Total_Stony_Corals	Total number of stony corals recorded in that survey	individuals
Zooanthid_Palythoa_caribaeorum	Number of individuals within this taxon	individuals
Total_organism_points_in_transect	Total organisms recorded in each survey	individuals
Other	Total points other than organisms recorded in each survey	individuals
Total_points_in_transect	Total points recorded in each survey	individuals

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Project Information

Collaborative Research: The Influence of Sponge Holobiont Metabolism on Coral Reef Dissolved Organic Matter and Reef Microorganisms (Sponge Holobiont DOM)

Coverage: Caribbean Sea

NSF Award Abstract:

The seawater around coral reefs is typically low in nutrients, yet coral reefs are teeming with life and are often compared to oases in a desert. Life exists in these 'marine deserts' in large part, due to symbiotic associations between single-celled microbes and invertebrates such as corals and sponges. The concentration and type of dissolved organic matter (DOM), a complex pool of organic nutrients such as amino acids, vitamins, and other diverse compounds, also affects the health of coral reefs. The composition of DOM on coral reefs is linked to both the composition of free-living microbes in the seawater and to the nutrition of filter-feeding organisms, such as corals and sponges. However, the factors that influence the composition of DOM on coral reefs and the consequences of how it changes are not well understood. Recent work suggests that sponges could have a significant impact on the composition of reef dissolved organic nutrients, depending on sponge species due to differences in filtration capacity and in their symbiotic microbial communities. This project characterizes how diverse sponge species process DOM on coral reefs and determines the impacts of this processing on the free-living microbial community. Seawater is collected from sponges (pre- and post- sponge filtration) on coral reefs in the relatively pristine region of Curacao, and incubation experiments measure the impact of sponge filtration on the growth of the free-living microbial community. The organic nutrients of seawater samples are analyzed using cutting-edge techniques to distinguish the types of nutrients that are processed by sponges. The incubation experiments, using free-living microbes collected from the coral reef, quantify the impact of sponge filtration on the growth and composition of this community. This project provides fundamental understanding of how sponges contribute to the base of the coral reef food web. As the human-driven impacts continue to alter the composition of organisms on reefs, this understanding is necessary to predict changes to reef microbial food webs and is thus essential for scientists, reef managers, and policy decision makers. This project trains undergraduate students and a postdoctoral scholar and contributes to undergraduate and K-12 education through development of sponge-centric lessons that focus on local U.S. east coast aquatic environments as well as coral reef ecosystems.

Sponges vary in their capacity to filter seawater and in their associated microbial communities, leading to diverse metabolic strategies that often coexist in one habitat. While it is well-established that sponges are important in processing dissolved organic matter (DOM), an important reservoir of reduced carbon compounds, and transferring this energy to benthic food webs, there has been limited work to understand the consequences of sponge processing on the composition of coral reef DOM and on pelagic food webs. Specifically, while studies have shown that exudates of corals and algae select for specific groups of picoplankton (autotrophic and heterotrophic, respectively), similar data for sponges are required to understand the multiple factors that shape the composition of DOM and of the picoplankton community on coral reefs. Thus, this project is aimed at addressing a major knowledge gap of the role of sponge-derived DOM (sponge exometabolome) in coral reef biogeochemistry. An in situ sampling design targeting prominent Caribbean sponges and picoplankton incubation experiments is coupled to address both the composition of sponge exometabolomes and delineate shifts in the picoplankton community derived from sponge exometabolomes. Molecular-level changes to seawater DOM by sponge processing and the impact of these changes on the overall coral reef DOM profile is assessed with two DOM analysis techniques: a commonly used fluorometry technique (fDOM analysis) and with high-resolution mass spectrometry (LC-MS/MS). Additionally, microbiome and functional gene profiling, growth metrics, and nutrient analyses are employed to assess changes in the picoplankton community in response to sponge exometabolomes. Advanced data analysis techniques then synthesize data generated by each approach to provide novel insight on a poorly uncharacterized biogeochemical pathway on coral reefs. The work outlined here represents entirely novel information on the impact of sponge metabolism on the composition of DOM, sheds light on biologically important molecules involved in benthic-pelagic coupling, and importantly, generates data using standardized methods, thus facilitating comparison to previous and future DOM datasets.

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-1924540
NSF Division of Ocean Sciences (NSF OCE)	OCE-1923962

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