DRAFT Turf cover data for coral-turf contact experiment

Website: https://www.bco-dmo.org/dataset/949552
Version: 1
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Project
» Positive Effects of Coral Biodiversity on Coral Performance: Patterns, Processes, and Dynamics (Coral Biodiversity)

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Abstract
Turf-coral interactions and their impacts relative to those of macroalgae were evaluated by placing corals (Acropora pulchra and Porites rus) in contact with turf communities from territories of two species of damselfishes, with two common macroalgae, and with inert algal mimics as physical controls. After 13 days, turfs reduced coral photosynthesis by 31–59%, while macroalgae and mimics had minimal effects. After 24 hours of contact, chemicals from turf surfaces suppressed coral photosynthesis, affecting A. pulchra more strongly than P. rus. The experiment was repeated during the austral winter using freshly collected turf and also turf that had been collected for the austral summer experiment and kept frozen. What we saw was the significant allelopathic effects observed during the austral summer experiment were undetectable during the austral winter experiment. [Isn't this the same abstract as ticket 5748 (dataset 949219)??]

Table of Contents

- Coverage
- Dataset Description
  - Methods & Sampling
  - Data Processing Description
  - BCO-DMO Processing Description
- Parameters
- Instruments
- Project Information
- Funding

Coverage

Location: Mo'orea, French Polynesia (17°29'18.6"S 149°52'53.9"W), < 3m depth
Spatial Extent: **Lat**:-17.4885 **Lon**:-149.881639
Temporal Extent: 2022-03-07 - 2022-09-11

Dataset Description

[How does this data relate to coral_algal_contact_data or coral turf allelopathy experiments? The abstract and methods are nearly identical, so we will need dataset-specific details.]

This dataset is part of a larger study of the coral reef ecosystem in Mo'orea, French Polynesia that examines mechanisms governing interactions between damselfish, corals, and turf algae. The different analyses from the broader study are listed here, with links to these associated data in the 'Related Datasets'

section below.

Analyses undertaken include:

- Fertilizer impacts on damselfish behavior (*Damselfish behavior video dataset 949539)*
- Fertilizer impacts on biomass plus isotopic composition of algal turfs (*Damselfish turf biomass dataset 9xxxxx)*
- Fertilizer impacts on coral predation and herbivory (*Corallivory dataset 9xxxxxx, Herbivory dataset 9xxxxx)*
- Impacts of fertilizer and caging on coral and algal growth (*Coral growth dataset 9xxxxx, Algal overgrowth dataset 9xxxxxx)*
- Coral-turf allelopathy (*Turf extracts PAM dataset 949219, Coral-algal contact dataset 9xxxxxx)*
- Species composition of turf gardens (***this dataset of Turf cover composition*** *+ supplemental for Coral Reefs paper)*

Organism identifiers for taxonomic names within this dataset:
Anotrichium tenue, urn:lsid:marinespecies.org:taxname:144506
Antithamnion sp., urn:lsid:marinespecies.org:taxname:143827
Boodlea sp., urn:lsid:marinespecies.org:taxname:144261
Caulacanthus ustularis, urn:lsid:marinespecies.org:taxname:145606
Centroceras minutum, urn:lsid:marinespecies.org:taxname:211902
Unidentified cerameaceae 3,
Ceramium codii, urn:lsid:marinespecies.org:taxname:144541
Chaetomorpha sp.,
Chondria sp.,
Cladophora sp., urn:lsid:marinespecies.org:taxname:143996
Coelothrix irregularis, urn:lsid:marinespecies.org:taxname:145846
Derbesia sp., urn:lsid:marinespecies.org:taxname:143814
Gelidiella machrisiana, urn:lsid:marinespecies.org:taxname:145570
Gelidiopsis intricata, urn:lsid:marinespecies.org:taxname:145819
Gelidiopsis scoparia, urn:lsid:marinespecies.org:taxname:212202
Gelidium isabelae, urn:lsid:marinespecies.org:taxname:372120
Herposiphonia delicatula, urn:lsid:marinespecies.org:taxname:214212
Herposiphonia pacifica, urn:lsid:marinespecies.org:taxname:371670
Hincksia mitchelliae, urn:lsid:marinespecies.org:taxname:145436
Hypnea spinella, urn:lsid:marinespecies.org:taxname:145635
Jania sp.,
Lyngbya sp.,
Neosiphonia apiculata, urn:lsid:marinespecies.org:taxname:376406
Neosiphonia sphaerocarpa, urn:lsid:marinespecies.org:taxname:146348
Polysiphonia herpa, urn:lsid:marinespecies.org:taxname:372336
Polysiphonia scorpulum, urn:lsid:marinespecies.org:taxname:144664
Unidentified Polysiphonia,
Sphacelaria novae-hollandineae, urn:lsid:marinespecies.org:taxname:214295
Sphacelaria rigidula,
Ulva flexuosa, urn:lsid:marinespecies.org:taxname:234468

Methods & Sampling

We utilized turfs from territories of *S. nigricans* and *S. punctatus* to assess: i) turf effects on corals, ii) differential impacts based on turf species composition, and iii) variance in effects on the coral *Acropora pulchra* versus *Porites rus*. Species composition of turfs in territories of *S. nigricans* versus *S. punctatus* was assessed by collecting turf haphazardly from territories (n = 12) of each damselfish species spread across an approximately 0.07 km2 region in both March and September 2022. Samples from *S. nigricans* territories were collected using a 1.3 cm grommet punch and from *S. punctatus* territories by cutting a similarly sized area from territories on *A. pulchra* bases. Turfs were stored in 4% formalin in seawater, and species composition quantified following methods of Diaz-Pulido and McCook (2002).

Data Processing Description

Code for processing data can be found at: https://github.com/naltmank/coral_turf_contact_exp ***[recommend getting a DOI for the code if possible]***

BCO-DMO Processing Description

- Imported data from source file "turf_species_cover.csv"into the BCO-DMO data system.
- Modified parameter (column) names to conform with BCO-DMO naming conventions. Replaced dot separators with underscores. The only allowed characters are A-Z,a-z,0-9, and underscores. No spaces, hyphens, commas, parentheses, periods, or Greek letters.
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- Converted date format from mm/dd/yyyy to yyyy-mm-dd (ISO Date 8601 format)
- Added a column for Season (either austral winter or austral summer)

[table of contents | back to top]

Parameters

Parameters for this dataset have not yet been identified

[table of contents | back to top]

Instruments

Dataset-specific Instrument Name	Walz in-situ PAM Fluorometer
Generic Instrument Name	Fluorometer
Dataset-specific Description	Treatment effects on corals were assessed with a Walz in situ pulse-amplitude-modulated (PAM) fluorometer directly at the site of coral-algal contact
Generic Instrument Description	A fluorometer or fluorimeter is a device used to measure parameters of fluorescence: its intensity and wavelength distribution of emission spectrum after excitation by a certain spectrum of light. The instrument is designed to measure the amount of stimulated electromagnetic radiation produced by pulses of electromagnetic radiation emitted into a water sample or in situ.

Dataset-specific Instrument Name	grommet punch
Generic Instrument Name	punch tool
Dataset-specific Description	Samples from S. nigricans territories were collected using a 1.3 cm grommet punch.
Generic Instrument Description	A punch tool is a tool used to make holes or indentations in materials. Examples include: grommet punch, perforator, hole punch, biopsy punch tool, core cutter.

[table of contents | back to top]

Project Information

Positive Effects of Coral Biodiversity on Coral Performance: Patterns, Processes, and Dynamics (Coral Biodiversity)

Coverage: Moorea, French Polynesia, South Pacific Ocean (17º32’S 149º50’W)

NSF Award Abstract:
Coral reefs are extremely diverse, supply critical ecosystem services, and are collapsing at an alarming rate, with 80% coral loss in the Caribbean and >50% in the Pacific in recent decades. Previous studies emphasized negative interactions (competition, predation) as structuring reef systems, but positive interactions in such species-rich systems could be of equal importance in maintaining ecosystem function. If foundation species like corals depend on positive interactions, then their fitness may decline with the loss of surrounding species, creating a biodiversity meltdown where loss of one coral causes losses of others. This project conducts manipulative field experiments to understand the role of coral biodiversity in facilitating coral growth, survival, resilience, and retention of these foundation species and the critical ecosystem services they provide in shallow tropical seas. This project is committed to: 1) Educating and exciting influential business and civic leaders about conservation and restoration of coastal marine systems before these systems lose ecological function and value. This will involve influential Rotary clubs within North Georgia/Atlanta (the major economic engine of the southeastern US) as an initial focus. 2) Using the Research News and Institute Communications Office at Georgia Tech and well-developed contacts with science writers to produce popular press pieces on important ocean ecology discoveries emerging from these studies. (3) Organizing a public workshop of internationally prominent scientists focused on Maintaining Marine Biodiversity as a Strategy to Sustain Ecosystem Services and Coastal Cultures and Economies. A previous effort like this, organized by the investigators, attracted about 200 attendees and was webcast to numerous high schools in Georgia and to foreign investigators in less developed countries that could not attend. Speakers also conducted in-person video interviews with local high school classes. Due to that success, this model will be repeated. 4) Working with an association of educators and cultural leaders in French Polynesia to produce electronic format presentations on our work and on reef conservation that are appropriate for use by both teachers and leaders within Polynesian culture.

Ecologists have excelled at demonstrating the importance of direct (often negative) interactions among species pairs. However, when these interactions occur in a complex context among thousands of other species in the field, the sum of the many, poorly-known, indirect interactions can counterbalance, or even reverse, the better-known direct interactions, generating diffuse mutualisms instead of agonistic outcomes. In a proof-of-concept initial experiment, coral growth and survivorship were greater in coral polycultures than monocultures, especially during early stages of community development. Processes generating this outcome are unclear but understanding these is of critical importance as diversity and function of reefs decline and as humans need to predict and adapt to changing environments. This interdisciplinary investigation merges expertise in experimental field ecology, chemical ecology, and the ecology of microbiomes to investigate the functional role of biodiversity in coral reef ecosystems. Experiments use a novel coral transplantation method and field manipulations to assess: 1) whether greater coral species diversity enhances coral community performance, as well as growth and survivorship of individual corals, 2) whether greater genotypic diversity enhances coral performance within a species, 3) whether greater diversity of seaweed competitors further suppresses corals and enhances seaweed performance, and 4) the processes driving the patterns documented above, including the roles of disease, intraspecific versus interspecific competition, predators, mutualists, and differential access to, or use of, resources. The research investigates the relationship between biodiversity and ecosystem function across dimensions of coral taxonomic diversity, from species to genotypes, and creates a series of experiments elucidating general principles underlying ecosystem dynamics. Filling these knowledge gaps advances our fundamental understanding of how biodiversity influences ecosystem function at multiple scales and provides insight into the processes promoting coral coexistence in these species-rich ecosystems. Findings will have practical implications for coral management and restoration and may improve predictions regarding coral reef resilience and recovery in the face of changing climate.

[table of contents | back to top]

Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1947522

[table of contents | back to top]