Palatability of Galaxaura & Sargassum to herbivores in the Viti Levu, Fiji from 2011 (Killer Seaweeds project)

Website: https://www.bco-dmo.org/dataset/488790
Version: 2014-01-22

Project
» Killer Seaweeds: Allelopathy against Fijian Corals (Killer Seaweeds)

Contributors	Affiliation	Role
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Methods & Sampling

In addition to allelochemical induction, we evaluated whether competition affected the growth of either seaweed or changed their susceptibility to herbivory. To evaluate changes in palatability, we then conducted paired feeding assays in the field using a portion of each autogenic treatment and control pair. We removed four branches from each treatment seaweed, spun them uniformly in a salad spinner to remove excess water, weighed the branches and inserted them 5 cm apart on a 60 cm section of 3-stranded rope. Ropes holding control seaweeds were assembled identically (n = 15 rope pairs species-1). Furthermore, a single branch of each seaweed from each pair was spun, weighed and inserted into a 20 cm segment of 3-stranded rope to be deployed as a caged control to assess changes in seaweed mass unrelated to herbivory.

Within the reserve, we deployed autogenic pairs of treatment and control seaweed in a network of pools accessible to herbivorous fishes at both low and high tide. We deployed pairs within approximately 0.50-0.75 m of each other, and caged controls within 1 m of each pair. Replicates were spaced by 5-7 m. We recollected pairs when approximately 50% of the total biomass (within pairs) was consumed; thus, tests for Sargassum lasted 2-24 h and tests for Galaxaura lasted 5-7 days. Following assays, seaweeds were bagged in situ and returned to the laboratory, where they were spun and re-weighed. We calculated the mass of each seaweed consumed using the formula: [Ti(Cf/Ci)] - Tf , where Ti and Tf were the initial and final masses (respectively) of a seaweed exposed to herbivory, and Ci and Cf were the initial and final masses (respectively) of its autogenic caged control protected from herbivory.

Relevant References:

* Rasher DB and ME Hay. "Competition induces allelopathy but suppresses growth and anti-herbivore defense in a chemically rich seaweed". Proceedings of the Royal Society: B-Biological Sciences. vol. 281 no. 1777 20132615, 2014 (http://dx.doi.org/10.1098/rspb.2013.2615).

Rasher DB, Stout EP, Engel S, Kubanek J, and ME Hay. "Macroalgal terpenes function as allelopathic agents against reef corals", Proceedings of the National Academy of Sciences, v. 108, 2011, p. 17726.

Beattie AJ, ME Hay, B Magnusson, R de Nys, J Smeathers, JFV Vincent. "Ecology and bioprospecting," Austral Ecology, v.36, 2011, p. 341.

Rasher DB and ME Hay. "Seaweed allelopathy degrades the resilience and function of coral reefs," Communicative and Integrative Biology, v.3, 2010.

Hay ME, Rasher DB. "Corals in crisis," The Scientist, v.24, 2010, p. 42.

Hay ME and DB Rasher. "Coral reefs in crisis: reversing the biotic death spiral," Faculty 1000 Biology Reports 2010, v.2, 2010.

Rasher DB and ME Hay. "Chemically rich seaweeds poison corals when not controlled by herbivores", Proceedings of the National Academy of Sciences, v.107, 2010, p. 9683.

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Data Files

File
seaweed_palatability.csv (Comma Separated Values (.csv), 6.62 KB) MD5:be5d0ef1878481e8c25baaeac06958f6 Primary data file for dataset ID 488790

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Parameters

Parameter	Description	Units
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees
date	date deployed	mm/dd/yyyy
duration	duration of experiment; seaweed pairs were recollected when approximately 50% of the total biomass (within pairs) was consumed so varied by species	hours or days
sample	identification number of treatment and control seaweed pair	unitless
species	species of seaweed	unitless
thalli_type	type of thalli treatment	unitless
mass_initial_herb	initial mass of seaweed from samples exposed to herbivores	grams
mass_final_herb	final mass of seaweed from samples exposed to herbivores	grams
mass_initial_cage	initial mass of caged seaweed	grams
mass_final_cage	final mass of caged seaweed	grams
mass_initial_herb_corr	initial mass of seaweed exposed to herbivores; corrected for change in caged seaweed	grams
amt_consumed_g	amount of seaweed consumed; wet weight	grams
amt_consumed_pcent	percent seaweed consumed by herbivores	percent

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Deployments

Fiji_2011

Website	https://www.bco-dmo.org/deployment/480730
Platform	Hay_GaTech
Start Date	2010-11-01
End Date	2012-01-01
Description	Studies for this deployment were conducted: November 2010 through February 2011 and between November 2011 and January 2012 on shallow (~1 m below the surface at low tide, equal or shallower than 2 m at high tide), intertidal fringing reefs platforms in Villages of Votua, Vatu-o-lalai and Namada, Coral Coast Viti Levu, Fiji. May–December 2011 on an approximately1.5-2.5 m deep reef flat within a no-take marine reserve at Votua Village, Viti Levu, Fiji.

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Project Information

Killer Seaweeds: Allelopathy against Fijian Corals (Killer Seaweeds)

Coverage: Viti Levu, Fiji (18º13.049'S, 177º42.968'E)

Extracted from the NSF award abstract:

Coral reefs are in dramatic global decline, with reefs commonly converting from species-rich and topographically-complex communities dominated by corals to species- poor and topographically-simplified communities dominated by seaweeds. These phase-shifts result in fundamental loss of ecosystem function. Despite debate about whether coral-to-algal transitions are commonly a primary cause, or simply a consequence, of coral mortality, rigorous field investigation of seaweed-coral competition has received limited attention. There is limited information on how the outcome of seaweed-coral competition varies among species or the relative importance of different competitive mechanisms in facilitating seaweed dominance. In an effort to address this topic, the PI will conduct field experiments in the tropical South Pacific (Fiji) to determine the effects of seaweeds on corals when in direct contact, which seaweeds are most damaging to corals, the role allelopathic lipids that are transferred via contact in producing these effects, the identity and surface concentrations of these metabolites, and the dynamic nature of seaweed metabolite production and coral response following contact. The herbivorous fishes most responsible for controlling allelopathic seaweeds will be identified, the roles of seaweed metabolites in allelopathy vs herbivore deterrence will be studied, and the potential for better managing and conserving critical reef herbivores so as to slow or reverse conversion of coral reef to seaweed meadows will be examined.

Preliminary results indicate that seaweeds may commonly damage corals via lipid- soluble allelochemicals. Such chemically-mediated interactions could kill or damage adult corals and produce the suppression of coral fecundity and recruitment noted by previous investigators and could precipitate positive feedback mechanisms making reef recovery increasingly unlikely as seaweed abundance increases. Chemically-mediated seaweed-coral competition may play a critical role in the degradation of present-day coral reefs. Increasing information on which seaweeds are most aggressive to corals and which herbivores best limit these seaweeds may prove useful in better managing reefs to facilitate resilience and possible recovery despite threats of global-scale stresses. Fiji is well positioned to rapidly use findings from this project for better management of reef resources because it has already erected >260 MPAs, Fijian villagers have already bought-in to the value of MPAs, and the Fiji Locally-Managed Marine Area (FLMMA) Network is well organized to get information to villagers in a culturally sensitive and useful manner.

The broader impacts of this project are far reaching. The project provides training opportunities for 2-2.5 Ph.D students and 1 undergraduate student each year in the interdisciplinary areas of marine ecology, marine conservation, and marine chemical ecology. Findings from this project will be immediately integrated into classes at Ga Tech and made available throughout Fiji via a foundation and web site that have already set-up to support marine conservation efforts in Fiji and marine education efforts both within Fiji and internationally. Business and community leaders from Atlanta (via Rotary International Service efforts) have been recruited to help organize and fund community service and outreach projects in Fiji -- several of which are likely to involve

marine conservation and education based in part on these efforts there. Media outlets (National Geographic, NPR, Animal Planet, Audubon Magazine, etc.) and local Rotary clubs will be used to better disseminate these discoveries to the public.

PUBLICATIONS PRODUCED AS A RESULT OF THIS RESEARCH

Rasher DB, Stout EP, Engel S, Kubanek J, and ME Hay. "Macroalgal terpenes function as allelopathic agents against reef corals", Proceedings of the National Academy of Sciences, v. 108, 2011, p. 17726.

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Funding

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