Seaweed growth, palatability, and chemical defense (anti-coral and anti-herbivore) following 8 days of contact with a coral competitor in the Viti Levu, Fiji from May 2011 (Killer Seaweeds project)

Website: https://www.bco-dmo.org/dataset/480725
Version: 2014-01-22

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

Contributors	Affiliation	Role
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Dataset Description

The study was conducted in 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. Seaweed species studied were Sargassum polycystum and the red seaweed Galaxaura filamentosa. Growth of the two species was measured as wet mass when closely associated with live or dead pieces of the coral Porites cylindrica. To assess growth, we measured the spun wet mass (g) of each treatment and control pair before and after the 8-day competition period.

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_growth.csv (Comma Separated Values (.csv), 5.69 KB) MD5:d5ffd648b974bdc23485ab53168efa3e Primary data file for dataset ID 480725

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Parameters

Parameter	Description	Units
date_begin	date when the experiment was begun	mm/dd/yyyy
date_end	date when the experiment was ended	mm/dd/yyyy
sample	identification number of treatment and control seaweed pair	unitless
species	species of seaweed: S. polycystum and G. filamentosa	unitless
treatment	seaweed in experiment: treatment = contact with coral; control = contact with skeleton	unitless
mass_initial	initial weight of seaweed	grams
mass_final	final weight of seaweed	grams
growth	change in weight from initial to final weighing	grams
growth_pcent	percent change in weight	percent
lat	latitude; north is positive	decimal degrees
lon	longitude; east is positive	decimal degrees

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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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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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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-0929119

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