

# Movement distance and direction data of tagged *Acanthaster* in Viti Levu, Fiji from 2010-2012.

**Website:** <https://www.bco-dmo.org/dataset/706039>

**Data Type:** Other Field Results

**Version:** 1

**Version Date:** 2017-06-23

## Project

» [Killer Seaweeds: Allelopathy against Fijian Corals](#) (Killer Seaweeds)

Contributors	Affiliation	Role
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## Abstract

Movement distance and direction data of tagged *Acanthaster* in Viti Levu, Fiji from 2010-2012.

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## Coverage

**Spatial Extent:** Lat:-18.21765 Lon:177.7163167

**Temporal Extent:** 2010 - 2012

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## Dataset Description

Movement distance and direction data of tagged *Acanthaster*.

## Methods & Sampling

To test whether *Acanthaster* selectively migrated into the MPAs versus the fished areas, 120 adults of  $36 \pm 2$  cm diameter (from the tips of opposite arms) were collected from the MPAs and adjacent fished areas of reefs flats near Votua, Vatu-o-lalai, and Namada villages, with 20 individuals collected from within and 20 from outside the MPAs at each village site (40 individuals village-1 site-1). Each individual was tagged with five plastic tag fasteners between the base of individual arms, and labeled flagging tape was attached to the end of each tag fastener to aid in location and identification. Individuals were then enclosed within cages located along the MPA border perpendicular to the coastline at each site (20 individuals border-1 location-1) for 48 h to allow for tag acclimation. Upon release, individuals' movements were monitored at 24 h intervals for four to eight days by physically locating each individual and recording its location via GPS (Garmin GPS 76CSX). GPS coordinates of individual *Acanthaster* positions were imported into ArcMAP (Version 10.3.1), and the Geospatial Modeling Environment extension (Version 0.7.4.0) was used to calculate individuals' initial and final directions of

movement relative to their release point along their respective MPA border, as well as each individual's net displacement between consecutive days.

## Data Processing Description

These data are based on calculations from raw GPS data (see [Acanthaster Tagging Locations](#)). Analyses performed to acquire these data are described in the methodology above.

### BCO-DMO Data Processing Notes:

- reformatted the column names to comply with BCO-DMO standards
- replaced spaces with underscores
- replaced "N/A" with "nd"

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## Data Files

File
<b>acanthaster_tagging.csv</b> (Comma Separated Values (.csv), 9.89 KB) MD5:b3b4add4c91a094d56c0919dc74dc983 Primary data file for dataset ID 706039

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## Related Publications

Clements, C. S., & Hay, M. E. (2017). Size matters: Predator outbreaks threaten foundation species in small Marine Protected Areas. PLOS ONE, 12(2), e0171569. doi:[10.1371/journal.pone.0171569](https://doi.org/10.1371/journal.pone.0171569)  
*General*

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## Parameters

Parameter	Description	Units
village	The village site where the data were collected on the Coral Coast of Viti Levu Fiji	unitless
border	The MPA border where individual sea stars were released and monitored.	unitless
acanthaster_origin	The location each sea star was collected from at each village site.	unitless
acanthaster_ID	The identification number for individual sea stars released at each MPA border	unitless
consecutive_days	The number of consecutive days an individual was successfully relocated.	days
total_displacement	An individuals total displacement (meters) between consecutive days that the individual was successfully relocated.	meters
mean_displacement	An individuals mean displacement (meters) between consecutive days that the individual was successfully relocated.	meters
initial_movement_angle	The angular direction (degrees) of an individuals initial movement (from release to first relocation) relative to the MPA border where they were released.	degrees
initial_movement_direction	The direction (i.e. into the MPA or fished area) of an individuals initial movement (from release to first relocation) relative to the MPA border where they were released.	unitless
final_movement_angle	The angular direction (degrees) of an individual's final movement (from release to final relocation) relative to the MPA border where they were released.	degrees
final_movement_direction	The direction (i.e. into the MPA or fished area) of an individuals final movement (from release to final relocation) relative to the MPA border where they were released.	unitless

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## Instruments

<b>Dataset-specific Instrument Name</b>	Garmin GPS 76CSX
<b>Generic Instrument Name</b>	GPS receiver
<b>Dataset-specific Description</b>	Used to monitor individuals' movements
<b>Generic Instrument Description</b>	Acquires satellite signals and tracks your location. This term has been deprecated. Use instead: <a href="https://www.bco-dmo.org/instrument/560">https://www.bco-dmo.org/instrument/560</a>

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## Deployments

### Fiji\_2011

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/480730">https://www.bco-dmo.org/deployment/480730</a>
<b>Platform</b>	Hay_GaTech
<b>Start Date</b>	2010-11-01
<b>End Date</b>	2012-01-01
<b>Description</b>	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 approximately 1.5-2.5 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 (18°13.049'S, 177°42.968'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.

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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## Funding

Funding Source	Award
<a href="#">NSF Division of Ocean Sciences (NSF OCE)</a>	<a href="#">OCE-0929119</a>
<a href="#">National Institutes of Health (NIH)</a>	<a href="#">U01-TW007401</a>

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