Dataset: Growth of mature caged Sargassum polycystum fronds from MPAs and non-MPAs when reciprocally transplanted

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

Abstract: Raw data on the growth of mature Sargassum polycystum fronds originated from marine protected and non-protected areas (MPAs and non-MPAs, respectively) in Fiji, reciprocally transplanted between these areas and protected by cages. Growth was measured as the difference between the final (30 days) and initial frond length, measured from a standard point established using a thread when the experiment was set. Details in Dell et al. 2016 Plos One. For a complete list of measurements, refer to the supplemental document 'Field_names.pdf', and a full dataset description is included in the supplemental file 'Dataset_description.pdf'. The most current version of this dataset is available at: http://www.bco-dmo.org/dataset/643915

Description: Growth of mature caged Sargassum polycystum fronds from MPAs and non-MPAs when reciprocally transplanted

Raw data on the growth of mature *Sargassum polycystum* fronds originated from marine protected and non-protected areas (MPAs and non-MPAs, respectively) in Fiji, reciprocally transplanted between these areas and protected by cages. Growth was measured as the difference between the final (30 days) and initial frond length, measured from a standard point established using a thread when the experiment was set. Details in Dell et al. 2016 Plos One.

Related Reference:
Dell, C., Longo, G.O., Hay, M.E. (2016) Positive feedbacks enhance macroalgal resilience on Degraded Coral Reefs. Plos One.

Related Datasets:
Sargassum recruit-sized survival - figure 3
Sargassum mature growth conspecific - figure 4
Sargassum recruit-sized growth and survival with conspecifics - figures 5 and 6

Acquisition Description: [Reference cited below are from Dell et al (2016) Plos One.]

Study site and species:
This study was conducted between January and May in 2013 and 2015 on the coral coast of Fiji's main island, Viti Levu, in the villages of Votua and Vatu-o-lailai (18°12'32S, 177°42'00E and 18°12'13S, 177°41'29E respectively; Fig 1). These villages are ~3km apart and each has jurisdiction over their stretch of reef flat; a habitat ranging between ~1.5 and 3m deep at high tide and between ~0 and 1.5m deep at low tide. In 2002, these villages established small areas (0.8km2 in Votua and 0.5 km2 in Vatu-o-lailai; Fig 1) as no-take MPAs [25]. Though MPA and non-MPA areas were initially similar in coral and macroalgal cover (33-42%

macroalgal cover; 3-12% coral cover [25]), MPAs now differ significantly from the adjacent non-MPAs in benthic cover and fish diversity and abundance. MPAs now have ~56% live coral cover on hard substrate, ~2% macroalgal cover, ~8 fold higher biomass of herbivorous fishes, and higher recruitment of both fishes and corals than the non-MPAs [5,22]. Meanwhile the non-MPAs have lower fish biomass, 5-16% live coral cover on hard substrates and 51-92% macroalgal cover, the majority of which is comprised by Phaeophytes (primarily Sargassum polycystum C. Agardh [22]). In the MPAs, macroalgal cover is restricted to the shallowest, most shoreward areas (where access by herbivorous fishes appears limited), whereas macroalgal cover in the non-MPAs extends throughout the habitat. Thus, over distances of only a few hundred metres, there are dramatic differences in community composition that may impact the efficacy of factors controlling macroalgal populations, without the confounding factors of great differences in space or time.

Effect of habitat and origin on the survival and growth of mature S. polycystum fronds

We used Sargassum polycystum as a study organism because it is often the most conspicuous macroalgal species on degraded Pacific reefs and can grow to dominate large areas [22,28-30]. On reefs lacking adequate herbivory, S. polycystum can reach 8.55 kg wet weight per square metre [28] and its odour can suppress both fish and coral recruitment [5], potentially limiting reef recovery. In Fiji, perennial holdfasts start regenerating in December and by the end of its growing season in June, S. polycystum commonly dominates large expanses of the unprotected reef flats [22,29]. Around this time it may reproduce sexually via spores that disperse only one to three metres [31], suggesting the potential for reduced connectivity between even nearby sites. After June, S. polycystum senesces leaving the perennial rhizomes sheltered within the reef structure. Populations in our study area will have undergone about 10 generations since MPA establishment, which has been shown to be adequate time for population differentiation among some species if selection is strong [24,32].

The dearth of S. polycystum in the MPAs and its high abundance in the non-MPAs could be due to differing physical conditions in those locations. To investigate the role of physical conditions and to test whether S. polycystum in these areas was acclimatising to the different local conditions, a reciprocal transplant experiment was performed between the MPAs and non-MPAs at two villages to measure survival and growth of mature S. polycystum as a function of origin (from the MPA or non-MPA) and habitat (placed in the MPA or non-MPA) when the fronds were protected from herbivory in cages.

The uppermost 15 centimetres of a S. polycystum frond was collected from 40 separate holdfasts in the MPA and 40 in the non-MPA of the villages of both Votua and Vatu-o-lailai. To minimise the likelihood of collecting multiple fronds from a single clone, the holdfasts were separated by at least two metres. The lowest five centimetres of each frond were defoliated, the fronds were then blotted dry with paper towels and weighed to the nearest 0.1g. The top of the defoliated section was marked by piercing the thallus with a needle and tying a thread at this 5cm point to set a standard from which to measure growth in length. One strand of S. polycystum from the MPA and one from the non-MPA were affixed 20cm apart in the centre of a 50cm piece of 3-strand rope. The lowest 5cm of each algal stipe was threaded through the rope to anchor the strand in place. Four ropes were affixed in each of five cages (dimensions 1m x 1m x 0.8m constructed of 1cm mesh) by the two 10cm end sections of each rope so that the rope's centre, holding the algae, was raised a few centimetres above the substrate. Five cages were anchored at a depth of ~1.2m at low tide in both each MPA and non-MPA so that cages at each location were separated by a minimum of two metres. After one month, the length (from the threaded point) and mass of each frond were measured to assess growth.

Change in length was measured in centimetres after two and four weeks. As mass measurements required removing the fronds from the water, to minimise stress to the organism, change in mass was measured in grams only after four weeks. Because significant effects were the same in each of these data sets, only results from height change at week four are reported. A mean change in length was calculated separately for the MPA and non-MPA adults in each cage, yielding an n=5 for each location. Within each independent cage, we calculated the mean growth of MPA origin fronds, the mean growth of non-MPA fronds, and used the difference between these values in paired t-tests run separately for each location testing the effect of origin on growth over the four weeks. These difference scores were normally distributed.

Processing Description: To investigate the effect of habitat (MPA or non-MPA) on growth, a Mann-Whitney U test compared MPA originated fronds transplanted into both habitats; the same was done for non-MPA originated fronds. All analyses were conducted in SPSS version 16.0 with a adjusted to a =0.025 to account for the multiple contrasts.

BCO-DMO Processing:

- added conventional header with dataset name, PI name, version date
- renamed parameters to BCO-DMO standard
- sorted according to database best practices, with slowest changing columns leftmost

- corrected longitutude from West to East degrees

Deployment Information

Deployment description for Hay_GaTech Fiji_2013

Studies of corals and seaweed were conducted on reef flats within no-take marine protected areas (MPAs) adjacent to Votua, Vatuo-lailai, and Namada villages along the Coral Coast of Viti Levu, Fiji in 2013.

Deployment description for Hay_GaTech Fiji_2015

A study of seaweeds was conducted on reef flats within no-take marine protected areas (MPAs) and non-MPAs adjacent to Votua, Vatuo-lailai, and Namada villages along the Coral Coast of Viti Levu, Fiji in 2013.

Instrument Information

Instrument	
Description	*local description not specified*
Generic Instrument Name	Scale
Generic Instrument Description	An instrument used to measure weight or mass.