The Diversity, Density and Size Distributions of Hermatypic Corals on Honduran Coral Heads in Relation to Coral Recruitment and Recovery

by

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To my mother, father, and grandmother,
for their support, patience, guidance and encouragement.

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Abstract

Coral reefs are extraordinarily diverse and have complex ecological dynamics. Variables such as structural diversity, geological age, physical conditions, oceanographic properties, and geographic isolation can ultimately render each reef unique. Major disturbances due to natural phenomena (e.g. El Nino, hurricanes) and human impacts (e.g. ocean acidification, eutrophication and global warming) alter these variables and cause the reef to continually change over time. After a major disturbance, whether it be a hurricane, bleaching event, or disease outbreak, coral cover generally declines sharply while algae colonizes dead coral. A reef that recovers rapidly from a disturbance and limits the extent to which algae inhibits future coral recruitment and growth (resilience) should be considered healthier than a reef with simply moderate to high coral cover.

Cayos Cochinos, a nearly 500km^2 marine protected area as of 1993, and Utila, a major dive training destination, both sit at the southern end of the Mesoamerican Barrier Reef System as part of the Honduran Bay Islands. Honduran reefs are little studied; the increased threats facing Caribbean reefs and the local importance of these particular reefs are the rationale for this planned longitudinal study. Coral heads 6-8 meters deep with 10-50 individual coral colonies were mapped and photographed at 9 sites per reef, then each colony was photographed perpendicular to its maximum dimensions. Individual colonies were identified to species, colony area (cm^2) was measured, and the degree of interaction with surrounding corals, sponges, macroalgae, and turf algae was be calculated based on the percentage of the colony periphery in direct contact with them.

Species distributions were biased towards *Montastrea sp*. All statistical analyses (3-factor PERMANOVA) on the effects on colony area and competition (% contact), between location, site nested within location, competitor group, and coral group, the only significant differences found were on % contact between competitors within certain sites. *Macroalgae sp* and turf algae were the strongest competitors. The same coral heads will be reanalyzed annually for the next 5-10 years to assess coral growth and mortality, coral recruitment, changes to coral diversity, and changes to the interaction with competitors. Large scale assessments of reef health or resilience can not yet be determined.

List of abbreviations and symbols used

MBR:	Mesoamerican Barrier Reef
MPA(s):	Marine Protected Area(s)
SST:	Sea surface temperature
Sp.:	species
GPS:	Global Positioning System
PERMANOVA:	permutational multiple analysis of variance
ANOVA:	analysis of variance
PRIMER:	Plymouth routines in multivariate ecological research
MS:	Mean squares
SS:	Sum of squares
Df:	Degrees of freedom
P:	Probability value
SE:	Standard Error

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Introduction

Coral reefs are extraordinarily biodiverse and sustain a set of ecological dynamics more complex than other marine environments (Knowlton, 2008). Variables such as structural diversity, geological age, physical conditions, oceanographic properties, and geographic isolation can ultimately render each reef unique. Major disturbances due to natural phenomena (e.g. El Nino, hurricanes, disease) or human impacts (e.g. ocean acidification, climate change, overharvesting) continually affect the reef's characteristics and dynamics over time (Knowlton, 2008). The decline of coral reefs worldwide warrants a reassessment of the capability of reefs to survive against a growing number of threats (Knowlton, 2008 and Norström *et al.*., 2009).

A healthy reef generally has high in coral cover and coral diversity (Gardner *et al.*, 2003); however, the true health of a reef is reflected in its resilience (Nyström *et al.*, 1998). Resilience is the ability of a reef to both resist disturbance (ex. resist bleaching or regain algal symbionts and survive after bleaching) and the rate of recovery of the reef following a disturbance (return to the original ecological state). A resilient reef ecosystem has the capacity to undergo organizational changes while retaining functionality and feedbacks (Nyström *et al.*, 1998). However, beyond the point to which a reef can resist change (a threshold), ecological feedbacks can result in alternative stable states or equilibria (Norström *et al*., 2009,). Eventually, a resilient reef will recover to its original state, but changes to the ecological dynamics may increase the vulnerability of the reef to future disturbances (Knowlton 1992, Nyström *et al.,* 2008).

At the centre of reef ecological dynamics are the interactions between algae, coral and herbivores. Recovery of a reef requires increased coral recruitment and growth, however competition for open substrate is high between algae and coral, therefore resilience can be indirectly measured by the extent to which algae inhibits coral recruitment and growth. Decreased coral cover, increased algae cover, and overgrowth of corals by algae characterize a loss of resilience and signify a shift away from a coral-dominated state (Figure 1). Although an increase in herbivores and algal grazing is likely, high numbers of urchins will significantly de-calcify dead and live coral, and a greater area of algal cover will dilute favourable grazing beyond maximum herbivore densities. An algae-dominated state is then likely to persist (Mumby 2007, Norström *et al.,* 2009).

A significant increase in algal cover since the 1980s has been documented throughout the Caribbean. High fishing pressure had reduced the density of herbivorous fish, leaving urchins as the primary grazers. The reefs reached a tipping point upon experiencing a disease-induced die-off of the herbivorous urchin *Diadema antillarum* and two branching species of hermatypic coral: *Acropora palmata and Acropora cervicornis* (Mumby *et al.*, 2007, Nyström *et al.,* 2008*)*. The reefs of Jamaica were some of the most afflicted, as recovery from the 1980 Hurricane Allen was aborted by the *Diadema* die-off, and then worsened by Hurricane Gilbert in 1988 (Hughes 1994). Simplified into a quantitative model by Mumby *et al.* (2007), the susceptibility of the reef to an algal-dominated state and loss of resilience was accurately predicted when empirical data from Jamaica was applied (Figure 2). As in Jamaica, the reduction in

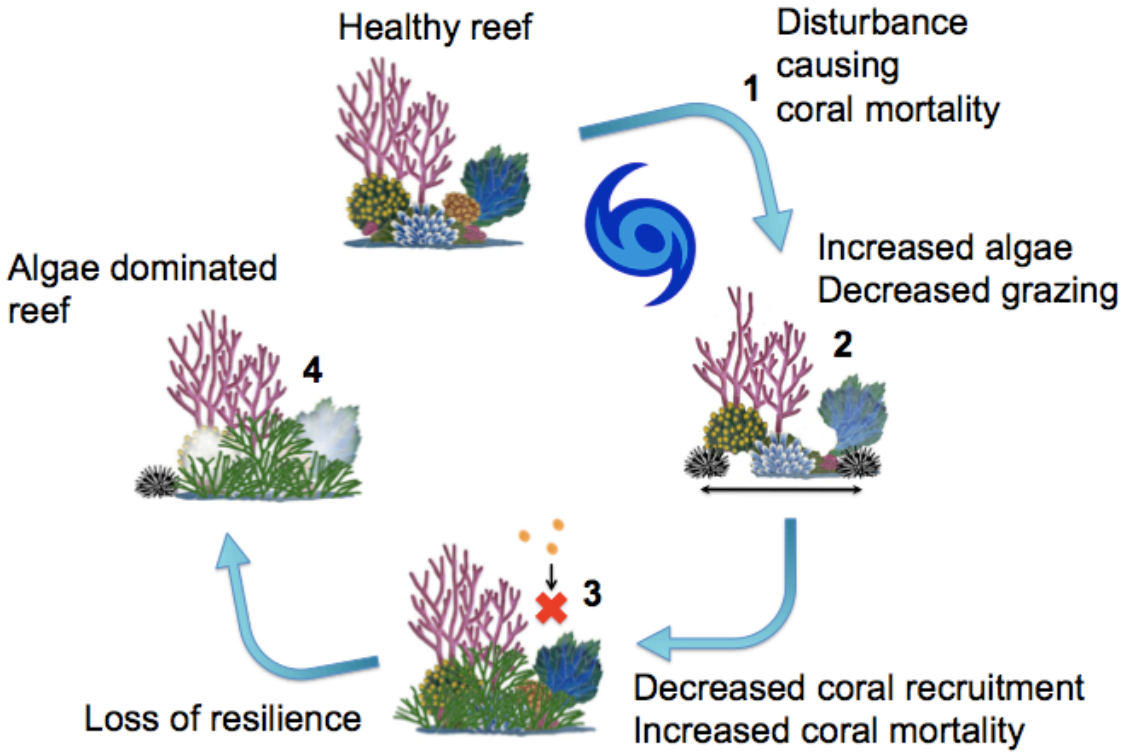

Figure 1. A macro-algal stable state results from ecological feedbacks. 1. A disturbance such as a hurricane creates structural damage and open substrate on the reef. 2.Open substrate is colonized by algae. Grazing pressure will decreased once maximum herbivore levels are diluted across a greater grazeable area. 3. Out competition of algae will cause a lack of recruitment to the reef due to a lack of suitable substrate for settlement, and increased coral mortality due to overgrowth. 4. This constitutes a lack of resilience whereby an algae-dominated state is likely to perpetuate.

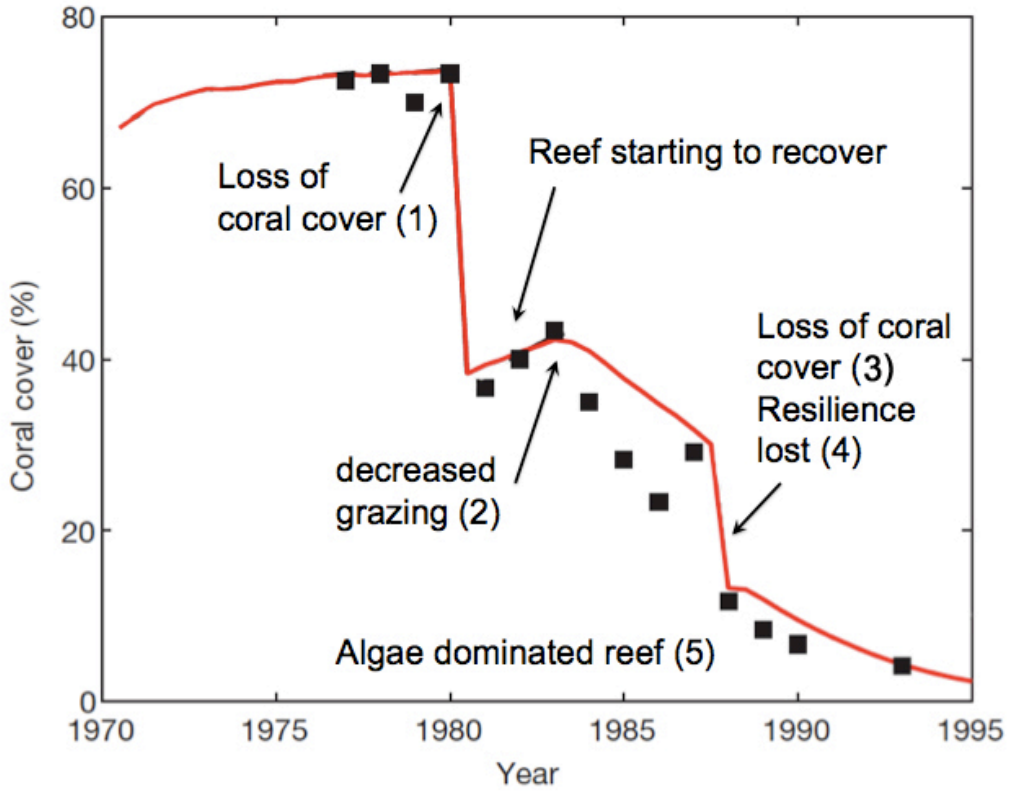

Figure 2. Jamaican reefs exist in an algae-covered state due to a loss of resilience (modified from Mumby *et al*., 2007). 1. Hurricane Allen caused a more than 20% loss of coral cover due to structural damage. 2. Due to resilience, coral cover began to increase in 1981 until the die-off of *D. antillarum* urchins in 1983 which led to a decrease in grazing pressure. 3. Some recovery was also recorded four years later, however Hurricane Gilbert in 1987 reduced coral cover beyond a critical point whereby resilience was lost (4) and the community shifted to an algae-dominated ecosystem (5). The red line represents model predictions, while the black squares represent empirical data.

maximum grazing pressure and structural coral diversity, along with routine physical disturbance by hurricanes, has caused most of the Mesoamerican Barrier Reef system to decline to a macro-algae dominated stable state (Mumby 2007).

The state of Honduran reefs has been poorly documented in comparison to other areas of the MBR. Eleven percent of Honduran reefs currently lie within Marine Protected Areas, but the degree to which nine of the 12 MPAs are protected is unknown (Burke and Maidens, 2004). Roughly 20 km from the mainland, the Honduran Bay Islands of Cayos Cochinos, Utila, Roatán, and Guanaja comprise the larger coral communities of Honduras. Cayos Cochinos (Cayos Menor and Cayos Mayor islands) is established as a marine protected area; the island of Utila is a major recreational diving destination (Figure 3). Roatán is a cruise ship port and has heavy resort development; Guanaja is only lightly developed. The reefs are generally fringing except for the largest of the islands, Roatán, which is protected by a mostly uninterrupted barrier reef to the north. Throughout the Bay Islands, the northern reefs are characterized by large and robust colonies such as *Montastrea annularis* due to higher wind and wave energy, whereas the leeward reefs tend to support more diverse coral assemblages (Harborne *et al.*, 2001).

As late as the 1990s, the reefs of the Honduran Bay Islands were considered healthy (high coral cover) (McField *et al.*, 2008). In 1998, Hurricane Mitch passed immediately to the east of the Bay Islands and wreaked extensive structural damage on the reefs (Figure 4). A mass bleaching event ensued shortly thereafter, compromising

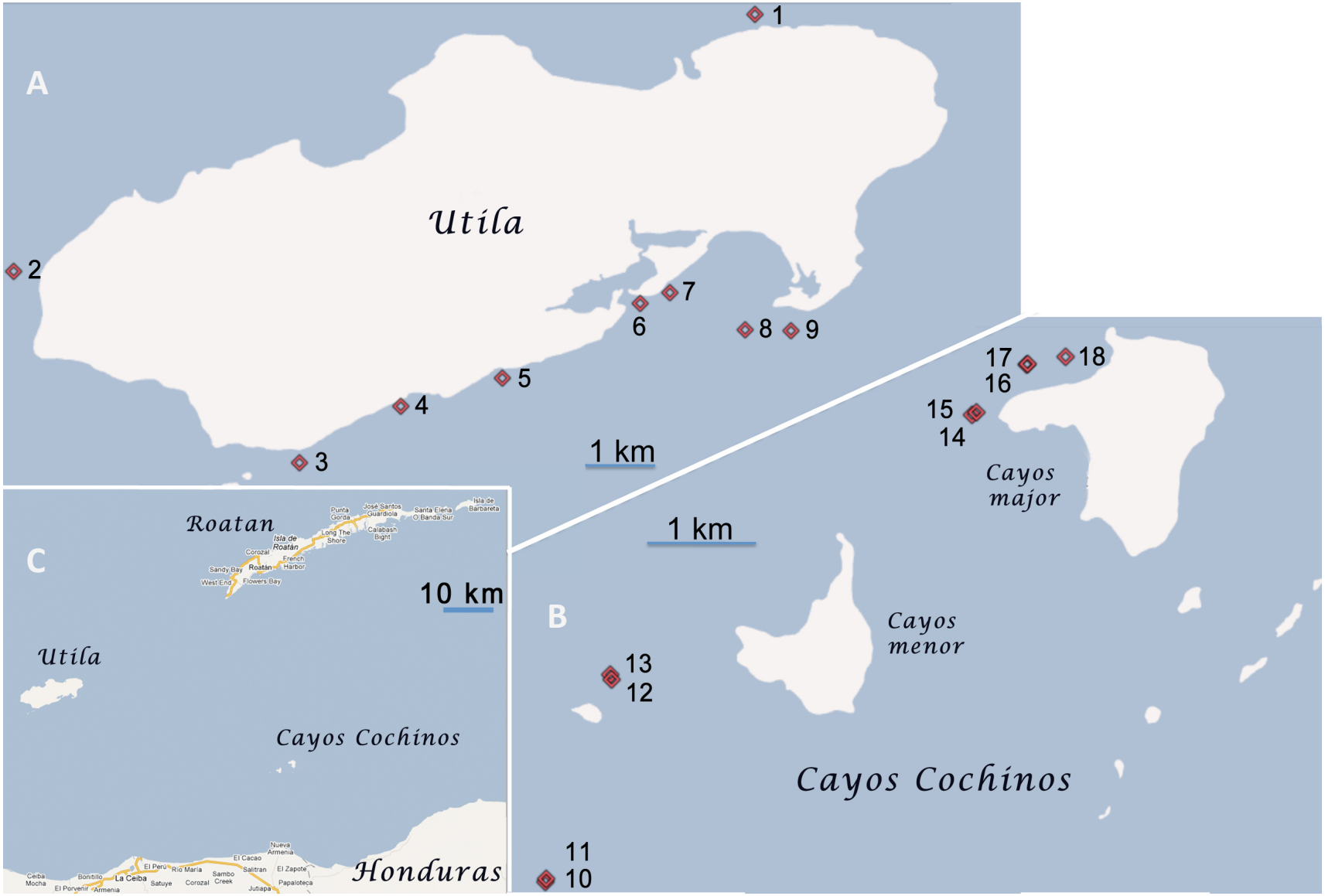

Figure 3. Red markers indicate selected reef sites surrounding Utila (A) and Cayos Cochinos (B) islands, displayed in relation to mainland Honduras (C). 1: Ironbound, 2: West End, 3: Stingray point, 4: Jack Neil's, 5: Little Bight, 6: Coral View, 7: Slumberland, 8:Lighthouse, 9: Stingray Alley, 10: Timon 1, 11: Timon 2, 12: Arena 1, 13: Arena 2, 14: Peli 0 1, 15: Peli 0 2, 16: Peli 2 1, 17: Peli 2 2, 18: Peli 2.5. Background image modified from 2010 Google Maps.

Figure 4. Storm path of Hurricane Mitch. Mitch was a category 5 hurricane when adjacent to the Honduran Bay Islands, slowing down to a tropical storm just before reaching the mainland of Honduras on October 29th, 1998. (Modified from Wikimedia commons: WikiProject Tropical cyclones/Tracks; the background image was provided by NASA, and tracking data was applied from the National Hurricane Center.)

many surviving coral colonies. Subsequent surveys reported 14-18% coral mortality, a high incidence of disease, and widespread fleshy and turf algae (Reich *et al*., 2001, McField *et al.*, 2008*)*. Further bleaching and disease outbreaks occurred in the following decade while additional threats continued to pervade the coral communities, such as overfishing, coastal development, sedimentation, and plantation runoff (Harborne *et al.*, 2001, Burke and Maidens, 2004, McField *et al.*, 2008).

The resilience of the reefs of Honduran Bay Island reefs remains unclear. There is some argument to suggest Mitch minimized the severity of the bleaching event in the Bay Islands by lowering sea surface temperature (SST) below bleaching threshold (Reich *et al*., 2001). Disease levels have also not increased consistently (Reich *et al*., 2001, McField *et al.*, 2008). There are no published data on current levels of coral cover or coral community structure.

This study aims to determine whether the reefs show signs of resilience and recovery towards a coral-dominated state by quantifying: A) relative coral species abundance, B) size distributions of living hermatypic colonies, C) the degree of competition/overgrowth from other corals, algae and sponges, D) the degree of competition in relation to size, and E) the incidence of disease and bleaching. The relative abundance and size distributions of the major competing hermatypic coral species will indicate which species are recruiting, and which corals are being overgrown. This is an initial study intended as the pilot year of a 5-10 year project; predictions of coral recovery and reef resilience from this initial time point will be checked against the actual reef recovery trajectory in future years. Reefs off Utila and Cayos Cochinos will be

compared to determine if the protected status of Cayos Cochinos results in a significantly healthier reef ecosystem. Each of these reefs is also important in itself; Cayos Cochinos as a protected sample of the MesoAmerican Reef, and Utila for its diving and ecotourism industry.

Materials and Methods

Site Selection

On the reefs surrounding Utila, and Cayos Cochinos islands, Honduras, 9 study sites were chosen at each location (Figure 3). Access to the reef was only granted to areas with an already established mooring. As a result of limited mooring sites, some pairs of sites at Cayos Cochinos were established 50 – 100m from each other on opposite sides of the same mooring. Each site at Utila was a separate mooring site. At each site, relatively small (<1.5m in diameter) and appropriately shallow (6 - 8m) coral heads with roughly 10-50 individual coral colonies were selected for analysis, mapped for future relocation, and permanently marked.

Photography

Each coral head was first photographed using a Nikon D80 10 megapixel DX format camera in an Aquatica housing with wide angle (12 - 24 mm) lens set at 12 mm. Starting by facing South, a photo was taken of the coral head at every 45˚ and from above, except where space did not permit. These sets of 9 photos were compiled to make full 360˚ image of each head. Then each individual coral colony present on the

	Sites	N	W
Utila	Coral View	16.05.317	86.54.674
	Iron Bound	16.07.472	86.53.783
	Jack Neil's	16.04.550	86.56.351
	Lighthouse	16.05.120	86.53.859
	Little Bight	16.04.760	86.55.743
	Slumberland	16.05.397	86.54.443
	Stingray Alley	16.05.113	86.53.503
	Stingray Point	16.04.128	86.57.317
	West End	16.05.555	86.59.536
Cayos Cochinos	Timon 1	15.56.317	86.31.383
	Timon 2	15.56.351	86.31.375
	Arena 1	15.57.274	86.31.072
	Arena 2	15.57.225	86.31.058
	Peli0 1	15.58.473	86.29.336
	Peli0 2	15.58.484	86.29.315
	Peli 2.5	15.58.740	86.28.888
	Peli2 1	15.58.704	86.29.075
	Peli2 2	15.58.707	86.29.070

Table 1. Sites selected and their respective GPS coordinates. Format is degrees.minutes.decimal minutes.

coral head was photographed perpendicular to its maximum dimensions while ensuring all living edges of the coral and a scale bar marked at 1 cm increments were within the frame, using an Olympus C5050 5 megapixel camera in an Olympus P015 housing with an Inon UWL-100 external wide angle lens.

Identification

Each coral colony was identified to the genus or species (if possible) level from the photographs with references to *Reef Coral Identification: Florida, Caribbean, Bahamas* (Humann and Deloach 2002). Photos compiled by Sheppard (2010) were additionally used to often confirm species identification. Together, the multiple images of each species and the species descriptions (especially average depth) resolved many of the ambiguous photos, as wide variation in growth forms, shapes and colouration can be exhibited by hermatypic corals, and microscopic features were unavailable (e.g. number of septa).

Common star coral, members of the *Montastrea* genus, were inherently hard to distinguish. In identifying *M. annularis,* an overall light green colouration and even, high corallite density made specimens distinguishable from the members of *M. faveolata*, who possess a darker, more brown colouration and slightly larger, more spaced corallites. This is especially true when colonies are small, as *M. faveolata*'s characteristic small, upward mounds and projections are often irregular and not arranged linearly. Colouration of *M. faveolata, cavernosa,* and *franksi* were sometimes similar, but the large, often puffy corallites of *M. cavernosa* and contrasting corallite centres

differentiated them from *M. franksi*, whose mottled colour (especially on edges) and rugged surface resolved any remaining doubt.

Lettuce coral (*Agaricia agaricites*) was very common but also very similar to other members of the *Agaricia* genus. It and low-relief lettuce coral (*Agaricia humilis*) were easily confused, especially when identifying small colonies; the growth pattern of *A. agaricites* is such that when a young recruit establishes on the reef, it is lacking the prolonged ridges and valleys that make it structurally different from *A. humilis*. Close attention was paid to *Agaricia* plate formations of dimpled sheet coral (*A. grahamae*) and fragile saucer coral *(A. fragilis*). The long valleys of *A. fragilis* made it very similar to individuals of *A. agaricites* form *purpurea*, except *A. fragilis* has concentric valleys. The lighter edges of *A. grahamae* were used to distinguish them from *A. agaricites,* because they do not whiten.

Reef algal species were identified when possible but to lesser taxonomic levels. *Reef Coral Identification: Florida, Caribbean, Bahamas* (Humann and Deloach 2002) includes many algal reef species, allowing for the majority of macroalgae to be identified to the genus level (eg. *Dictyota sp., Lobophora sp., Halimedia sp.,* and *Jania sp.*). Filamentous (turf) algae were simply noted as present. Identification of sponge species was not attempted due to their ambiguous nature in combination with the photograph resolution.

Measurement

The plan area (cm^2) and the perimeter length (cm) of each individual hermatypic

colony were measured using the program Image J (National Institutes of Health, USA), calibrated to the scale bar or callipers in each frame. In addition, the width and/or height of all gorgonian and soft corals were recorded. The degree of interaction with surrounding corals, sponges, macroalgae, and turf algae was calculated based on the percentage of the hermatypic colony periphery in direct contact with them. The visible edges of each hermatypic colony were categorized in one of three states: 1. mostly active growth, 2: equal amount of active growth and passive overgrowth, 3: mostly being overgrown. The presence of discoloration or disease of any coral was noted.

The same coral heads will be reanalyzed biannually for the next 5-10 years. The 360˚ image serves as a reference for the proximity of neighbouring colonies, as well as for the overall mapping and percent coral cover of the coral head in future years.

Statistical Analyses

To facilitate comparisons while increasing sample size, scleractinian colony species were pooled by morphology and/or genera to create seven functional species groups (Table 2). Similarly, competitors were pooled by type and/or species (Table 3). Size classes are commonly used to show the shape of a size frequency distribution when using a large sample number. Colony sizes were assigned to eight size classes with emphasis on small classes because size data was left skewed (1-10 cm^2, 10-20 cm^2, 20-30 cm^2, 30-40 cm^2, 40-50 cm^2, 50-100 cm^2, 100-300 cm^2, more), and counted per site per coral functional group.

Table 2. Functional groups assigned to scleractinian colonies based on morphology and/or genera

Group	*Agaricia sp.*	*Agaricia sp.* 2	*Montastrea sp.*	Dome	Encrusting	Branching	Plate
Description	encrusting/ mounds	plate forming	genus	rounded heads or domes	encrust substrate	branching clumps	plate forming (other)
Species	*A. agaricites* *A. humilis*	*A. fragilis* *A. lamarcki* *A. grahamae* *A. tenuifolia*	*M. annularis* *M. cavernosa* *M. faveolata* *M. franksi*	*D. strigosa* *D. labyrinthiformis* *I. sinuosa* *C. natans* *D. stokesii* *S. bournoni* *S. siderea* *S. intersepta* *M. areolata* *Me. Meandrites*	*P. asteroides* *S. hyades* *Ma. senaria* *Ma. pharensis* *S. radians*	*P. porites* *P. furcata* *P. divaricata* *Ma. formosa* *Ma. decactis* *Ma. mirabilis*	*My. lamarckiana* *My. ferox* *My. danaana* *H. culcullata*

Table 3. Functional groups assigned to neighbouring competitors based on abundance and/or genera

Group	*Dictyota*	Macroalgae	Gorgonian	*Millepora*	Scleractinian	Sponge
Perimeters mainly in contact with	*Dictyota sp*. macrolagae	combination of macroalgae species	Gorgonian/ Octocorals	fire coral	Stony coral (see appendix for full list)	burrowing or encrusting sponges
Species	*Dictyota sp.*	*Dictyota sp.* *Jania sp.* *Halimeda sp.* *Lobophora sp.*	*Gorgonian sp.* *Eunicea sp.* *Plexaurella sp.* *Pseudopterogorgia sp.* *Pterogorgia sp.*	*Millepora alcicornis*	*Agaricia sp.* *Montastrea sp.*	*Cliona sp.* *Chondrilla nuculla* *Mycale laevis* *Monanchora sp.* *Xestospongia proxima* *Desmapsamma anchorata*

To determine the effects of location (fixed factor with 2 levels, Utila and Cayos Cochinos), site (random factor nested in location with 18 levels), and coral group (fixed factor with 7 levels) on actual colony size, we used a 3-factor permutational multiple analysis of variance (PERMANOVA) conducted on the Euclidean distance matrix of colony sizes. This analysis was selected because it allows the data to deviate from normality, as otherwise assumed in ANOVA using a traditional *F*-statistic, because a *pseudo-F* is computed through random permutations to then obtain p-values for each term (Anderson *et al*. 2008). Size samples were reverse log transformed (log(c-x), where c > max x, c =700) due to left skewness (Clarke and Gorley 2006).

To assess competition using % contact, we tested for differences between samples grouped 1) by location, site, and competitor (fixed factor with 7 levels) and 2) by location, site, and coral group, two further 3-facter PERMANOVAs were conducted on the Euclidean distance matrices, and contact samples (%) were arcsin transformed (Clarke and Gorley 2006).

To determine any differences based on colony size class, we used a 3 factor (location, site nested in location and size category) PERMANOVA on the Bray-Curtis similarity matrix of the log (x+1) transformed frequency in each size category. Bray-Curtis is typically used on abundance data but cannot be estimated between 2 samples with zero counts (Clarke and Gorley 2006). To this end, all samples that were undefined in the matrix were removed from the analysis. The mean size was also calculated per group for all sites regardless of size class.

Compared to a significance level of $\alpha = 0.05$, factors found to have a significant effect on the samples were analysed using a post hoc pairwise test. All PERMANOVA we conducted using PRIMER with PERMANOVA+ (v. 6, PRIMER-E Ltd., Plymouth, UK).

Results

Relative coral species abundance

A total of 709 coral colonies were successfully photographed and quantified (Table 4). Individuals of 37 different hermatypic species were recorded across the two sites: 31 species at Utila, and 26 at Cayos Cochinos. 1% of hermatypic corals were unable to be identified (n=7), and 23% of all colonies were soft corals. The most common species are *Montastrea annularis* (24%), *Agaricia agaricites* (18%), and *Montastrea faveolata* (8%).

Size distributions of hermatypic colonies

There was no effect of any factor on colony size when applied to either reverse log transformed or untransformed samples (Table 5). Despite the log transformation, there was also no effect of any factor on size frequency (Table 6). Mean colony size (cm^2) per functional group for all sites is displayed in Figure 5. Due to sample sizes as small as 1 or 2 colonies, standard error of some of the means is considerably large.

		Coral Species																																								
		A. celvicornis	*A. agaricites*	*A. fragilis*	*A. grahamae*	*A. humilis*	*A. lamarcki*	*A. tenuifolia*	*C. natans*	*D. stokesii*	*D. labyrinthiformis*	*D. strigosa*	*H. cucullata*	*I. sinuosa*	*Ma. decactis*	*Ma. formosa*	*Ma. mirabilis*	*Ma. pharensis*	*Ma. senaria*	*M. areolata*	*Me. meandrites*	*Mi. alcicornis*	*Mo. annularis*	*Mo. cavernosa*	*Mo. faveolata*	*Mo. franksi*	*My. danaana*	*My. ferox*	*My. lamarckiana*	*P. asteroides*	*P. divaricata*	*P. furcata*	*P. porites*	*S. radians*	*S. siderea*	*S. bournoni*	*S. hyades*	*S. intersepta*	*Unknown*	***Total***	*Gorgonians*	***Total***
Utila	Coral View		22			8			1		1				1			1			2	1	1		2				1	4			4	1	1					**51**	12	**63**
	Iron Bound		4			2				1	3	2		1									8	1																**22**	0	**22**
	Jack Neil's		6	1	1	4	1								1								4	1	4	1				1									1	**26**	1	**27**
	Lighthouse		11	3		3			1							1			3				6	1	12					2			2		1					**46**	9	**55**
	Little Bight		6			1																2	2	1	9							1						1		**23**	4	**27**
	Slumberland		4		1	1													1				11		11					2			1		1	1			1	**35**	3	**38**
	Sting Ray Alley		19	1		1						1										1	9		1					2			1							**36**	10	**46**
	Sting Ray Point		3							3	1						1					2	2		3					1	3		4							**23**	5	**28**
	West End		9										1			1							15		1	1							1							**29**	10	**29**
Total		**0**	**85**	**5**	**2**	**20**	**1**	**0**	**2**	**4**	**5**	**3**	**1**	**1**	**2**	**2**	**1**	**1**	**4**	**0**	**2**	**6**	**58**	**4**	**43**	**2**	**0**	**0**	**1**	**12**	**3**	**1**	**13**	**1**	**3**	**1**	**0**	**1**	**2**	**291**	**54**	**345**
Cayos Cochinos	Arena 1		5			1																6	5		3	3		1	1	4										**29**	18	**47**
	Arena 2		10																				17			1	1													**29**	9	**38**
	Peli 0		3												1					1			11	3						1										**20**	3	**23**
	Peli 0-2		6		2	1									2								20	2		1				1					1					**36**	8	**44**
	Peli 2-1		1	1		1							1										11																3	**15**	17	**32**
	Peli 2-2	1	5									1	1	1									20		9	2			2	2									1	**44**	33	**77**
	Peli 2-5		7	4																								1		1										**13**	10	**23**
	Timon 1		4		1	1	1	4			1	3	1																						6					**22**	6	**28**
	Timon 2		5			1									2								29							3					1	1	1			**42**	6	**48**
Total		**1**	**46**	**5**	**3**	**5**	**1**	**4**	**0**	**0**	**1**	**4**	**3**	**1**	**5**	**5**	**0**	**0**	**0**	**1**	**0**	**6**	**113**	**5**	**12**	**7**	**1**	**2**	**3**	**12**	**0**	**0**	**0**	**0**	**8**	**1**	**1**	**0**	**4**	**255**	**109**	**364**
Grand Total		**1**	**131**	**10**	**5**	**25**	**2**	**4**	**2**	**4**	**6**	**7**	**4**	**2**	**7**	**7**	**1**	**1**	**4**	**1**	**2**	**12**	**171**	**9**	**55**	**9**	**1**	**2**	**4**	**24**	**3**	**1**	**13**	**1**	**11**	**2**	**1**	**1**	**6**	**546**	**163**	**709**

Table 4. Summary of species abundance per site. Unknowns refer to individuals that couldn't be identified confidently.

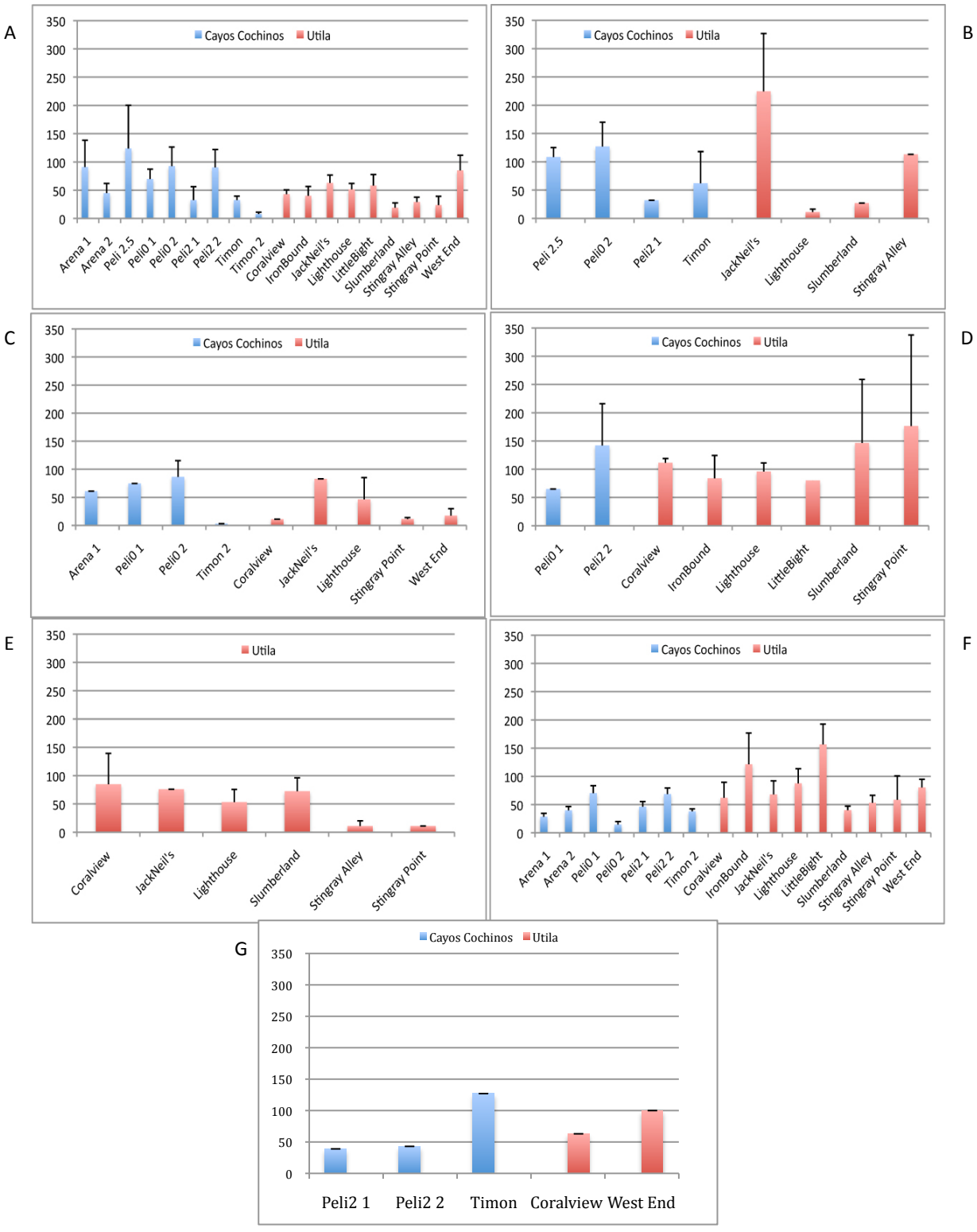

Figure 5. Mean colony size (cm^2) ± SE per functional group (A) *Agaricia sp.* (B) *Agaricia sp. 2* (C) Branching (D) Dome (E) Encrusting (F) *Montastrea sp.* (G) Plate for all sites per location.

Table 5. PERMANOVA results for the effects of location, site nested within location, and coral group on actual colony size. (A) Untransformed data, (B) reverse log transformed data (log(c-x), where c > max x, c =700). A significance level of α = 0.05 was used.

A. Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Location	1	487.13	487.13	9.23E-02	0.797	996
Group	6	33648	5608	0.99329	0.422	997
Site(Location)	16	79878	4992.4	0.92167	0.446	999
Location x group	5	45147	9029.4	1.5956	0.205	999
Site(Location) x Group	41	2.39E+05	5825.9	1.0756	0.367	997
Res	430	2.33E+06	5416.7			
Total	499	2.94E+06				

B. Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Location	1	7.99E-03	7.99E-03	0.25044	0.652	999
Group	6	0.165	2.75E-02	0.69269	0.613	999
Site(Location)	16	0.40813	2.55E-02	0.72728	0.478	999
Location x group	5	0.20766	4.15E-02	1.0392	0.409	999
Site(Location) x Group	41	1.7767	4.33E-02	1.2355	0.232	999
Res	430	15.082	3.51E-02			
Total	499	18.837				

Table 6. PERMANOVA results for the effects of location, site nested in location and size class on size frequency (log transformed). Undefined samples were removed and a significance level of α = 0.05 was used.

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
Location	1	178.03	178.03	0.33444	0.636	999
Size Class	7	3316.5	473.79	1.6521	0.113	999
Site(Location)	16	8981.1	561.32	1.2417	0.236	999
Location x size class	7	2035.2	290.74	1.0138	0.44	998
Site(Location) x size class	90	22770	253	0.55965	0.999	999
Res	108	48824	452.07			
Total	229	85804				

Competition from other corals, algae and sponges

Significantly different levels of contact were found between competitors within certain sites, yet no effect of coral functional group was found (Table 7, 8). The post hoc pairwise test on the effect of site nested within location with competitor group reveals which competitors demonstrate significantly different % contact (Table 9). Histograms of average % contact, grouped by site where there is a significant difference ($\alpha = 0.05$) between competitor groups are in Figure 6. Macroalgae is the competitor group with the strongest presence, averaging ~40% contact. At Arena 1 and Ironbound, and Arena 2 and Slumberland, contact levels of sponge and turf reached above 60% respectively.

Competition and edge status in relation to size

The majority of coral colonies at both locations were assigned an edge status of 2. Because there was no relationship found between coral species and size, nor by site, the relationship between edge status, site, and size was not tested.

Incidence of disease and bleaching

Colonies observed to be bleached or infected with a disease were few, and often unconfirmed due to the photographic quality. At Arena 1, Cayos Cochinos, a colony of *Mycetophyllia ferox* was bleached (34%), as well as one colony of *Mycetophyllia lamarckiana* at Coralview, Utila. One case of yellow blotch disease was identified on a *Montastrea annularis* colony at Timon 2, Cayos Cochinos.

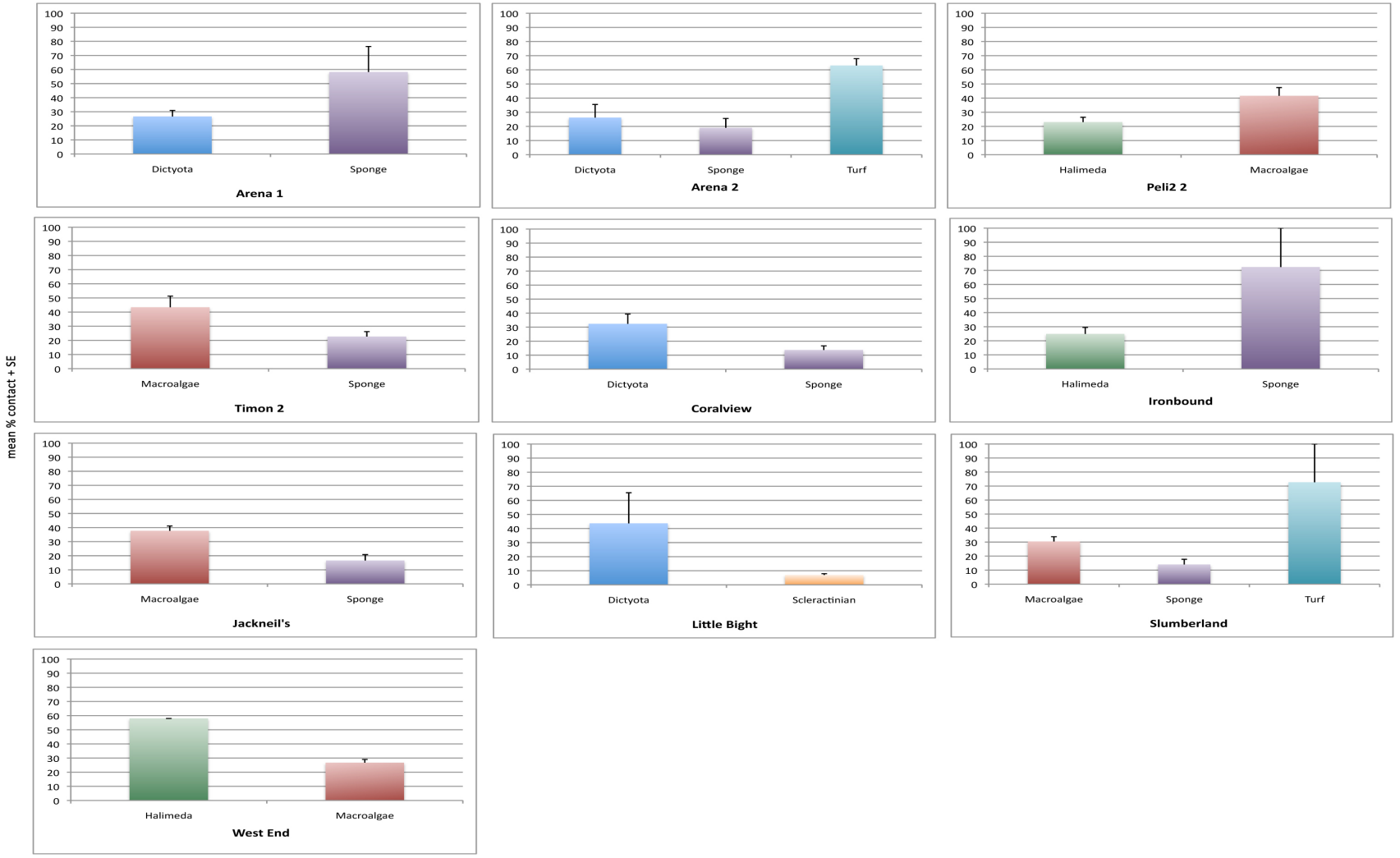

Figure 6. Average % contact (cm^2 + SE) for competitor groups with statistically different levels of competition at 10 sites, based on a post hoc pairwise test on the effect of site nested within location with competitor group (Table 9).

Table 7. PERMANOVA results for the effects of location, site nested in location and competitor on % contact (arcsine transformed). A significance level of α = 0.05 was used. Significant effects are in bold.

Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**	**Unique perms**
Location	1	2.02E-02	2.02E-02	0.26059	0.613	995
Competitor	**7**	**6.6615**	**0.95165**	**9.3292**	**0.001**	**998**
Site(Location)	16	1.3618	8.51E-02	1.2234	0.276	997
Location x competitor	7	0.23354	3.34E-02	0.32706	0.912	999
Site(Location) x competitor	**75**	**9.1694**	**0.12226**	**1.7573**	**0.011**	**999**
Res	475	33.046	6.96E-02			
Total	581	52.059				

Table 8. PERMANOVA results for the effects of location, site nested in location and coral functional group on % contact (arcsine transformed). A significance level of α = 0.05 was used.

Source	**df**	**SS**	**MS**	**Pseudo-F**	**P(perm)**	**Unique perms**
Location	1	2.00E-03	2.00E-03	2.77E-02	0.863	997
Group	6	0.40422	6.74E-02	0.61996	0.676	998
Site (Location)	16	0.97863	6.12E-02	0.72831	0.671	999
Location x group	6	0.17176	2.86E-02	0.26344	0.938	999
Site (Location) x group	51	6.3701	0.1249	1.4873	0.074	999
Res	501	42.075	8.40E-02			
Total	581	52.059				

Table 9. Post hoc pairwise test results of the interaction between site nested within location with competitor group on level of contact. Only sites where there was a significant difference (α = 0.05) between competitor groups are listed.

Location/Site	Competitor groups	t	P(perm)	Unique perms
Cayos/Arena 1	Dictyota, sponge	2.2341	0.037	182
Cayos/Arena 2	sponge, Turf	4.7191	0.001	243
Cayos/Arena 2	Dictyota, Turf	3.5205	0.006	204
Cayos/Peli2 2	macro, Halimeda	2.2814	0.027	347
Cayos/Timon 2	macro, sponge	2.2511	0.016	318
Utila/Coralview	Dictyota, sponge	2.1704	0.05	167
Utila/Ironbound	sponge, Halimeda	2.9403	0.037	62
Utila/Jackneil's	macro, sponge	3.0667	0.008	159
Utila/Littlebight	Dictyota, scleractinian	1.4094	0.028	32
Utila/Slumberland	macro, sponge	2.7365	0.015	167
Utila/Slumberland	macro, Turf	4.1945	0.02	135
Utila/Slumberland	sponge, Turf	3.4143	0.035	59
Utila/West end	macro, Halimeda	3.1291	0.039	16

Discussion

Relative coral species abundance

It is most important to note that the relative coral abundances recorded in Table 4 are not thought to be reflective of the overall species composition or diversity of the two locations (Selig and Bruno 2010). This misrepresentation arises from the fact that sampling sites were not randomly assigned; they were individually selected based on size (too big and they have too many colonies to photograph in a reasonable time; too small and they do not have enough colonies), depth, access for photography, proximity to mooring sites, and species composition. *Montastrea sp.*-dominated heads were chosen almost exclusively because they are the main remaining structure builder on the reef, were common, and were often about the right size. Due to lack of availability,

mooring sites at Cayos Cochinos were also biased towards the northern side of the islands where *Montastrea annularis* tend to dominate, whereas moorings were somewhat concentrated on the calmer waters South of Utila (Harborne *et al.*, 2001). As for *Agaricia sp*., the strong presence reported here may correctly coincide with some reports that high relative abundances of *Agaricia sp.* are part of a shift away from framework-building species (such as *Montastrea sp*.) (Edmunds and Carpenter, 2001). Ultimately, the relative soft and stony species abundances of these heads will be of greatest value in future years to observe any changes to head composition, with the potential to serve as an indication of which species are better competitors, and therefore impart a reef greater resilience.

Size distributions of hermatypic colonies

The null result of size data, transformed, untransformed and pooled by group or by size class, can be attributed to a large spread of data, small number of replicates, and misrepresentation of species composition. For example, dome-forming colonies at Stingray Point, Utila, were a sample size of only four, yet ranged from 13 cm^2 to 660 cm^2, while a different site at the same location had more than 60 samples for *Agaricia sp*. Raw sample size means per group and site indicate that the heads at some sites were composed differently; for example *Montastrea sp.* heads at Ironbound were significantly larger than all but one other site at Utila, perhaps because Ironbound is the most northerly site (Figure 5F) (Harborne *et al.*, 2001). However, an effect of location should be taken with some reservations, as the mean sizes of *Agaricia sp*. and

Montastrea sp. for the paired sites at Cayos Cochinos (Arena 1 vs 2, Peli0 1 vs 2, and Peli2 1 vs 2) are all significantly different from each other despite being only a minimum of 50 m apart.

To further increase sample size, it is recommended that in the future different functional groups be attributed to corals: either pooling *Montastrea* sp. with other encrusting or dome forms and *Agaricia sp 2* with other plate forms, or grouping species by average maximum colony size (ex separating *C. natans* and *M. meandrites*). Furthermore, it might be useful to disregard large colony sample sizes or size classes: the interest in the effect of site, location or group on colony size stems from the notion that any significant trend of smaller colony size (less than 50 cm^2) would reflect areas or species with high recruitment and overgrowth.

Competition

The significant differences in contact between various competitor groups at multiple sites suggests that not all coral head communities are faced with the same level of threat from algae, sponges and other corals. Although this may be due to site-specific conditions that favour one form of competitor over another, these differences may also be due to the nature of the competitor and result in differing competitor ability. For example some sponges such as *Mycale laevis* burrows into the underside of corals, this protects the colony from bioerosion, but likely interferes with the growth of the colony as well (Humann and Deloach 2002). In this sense, comparable levels of sponge and

macroalgae contact would not necessarily lead to the same level of coral overgrowth and mortality.

With the exception of one site at each location, macroalgae or turf algae contribute the greatest degree of contact. Monitoring the relative contact of these algal species over the following years may reveal early indications in the progression of an algae-dominated state across sites. Because there was no effect of location on the % contact sample means, there is no comparison to be made on the state of Utila and Cayos Cochinos.

Edge status measurements were initially intended in part to gauge competition. If a significant relationship between coral species and size had been found, edge status could have given an initial reference point in monitoring if the significantly smaller coral species were seemingly growing or being overgrown over time. In future studies, determining the interaction between edge status, site, and % competition would also be of interest. If competition (% contact) varies significantly by site and competitor, as it has been found to do here, a significant difference in edge status by site and competitor could hint at which of the competitors effects a stronger impact on the colony. However, this may not be a reliable comparison unless the edge status could take into account the competitive ability of various sponges, for example the state of the underside is not necessarily reflected in the edge status designations.

Reef Health, Future Studies and Summary

Due to the lack of statistical significance, no large scale comparisons can be made on the health of the reefs at Cayos Cochinos and Utila, although coral diversity, albeit biased, is not likely poor. As for the size data, the edge status data will be of greatest use when used to quantify and monitor the growth of these same coral colonies over time. Replicability of the differences in competition levels may reveal sites that are more resistant to overgrowth and should be protected. The episodic nature of coral disease outbreaks and bleaching events makes it possible that levels were low at the time of photography. It will be of value to continue to monitor levels of disease and bleaching, as the severity of bleaching events and the rate of spread of diseases during outbreak will also be ascertainable.

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Reef	Site	Image file	Genus/Species	Size cm2	Periphery cm	Height	Width
Utila	Coralview	p1010088	Gorgonia ventilana				
Utila	Coralview	p1010090	gorgonia sp				
Utila	Coralview	p1010091	monanchora sp				
Utila	Coralview	p1010092	Plexaurella sp				
Utila	Coralview	p1010093	pseudopterogorgia bipinnata				
Utila	Coralview	p1010095	Gorgonia ventalina				
Utila	Coralview	p1010096	Gorgonia mariae				
Utila	Coralview	p1010097	Plexaurella nutans				
Utila	Coralview	p1010098	Gorgonia ventalina				
Utila	Coralview	p1010099	Gorgonia ventalina				
Utila	Coralview	p1010100	pseudopterogorgia bipinnata				
Utila	Coralview	p1010101	millepora alcicornis				
Utila	Coralview	p1010102	Gorgonia ventalina				
Utila	Coralview	p1010104	Gorgonia ventalina				
Utila	Coralview	p1010105	sponge				
Utila	Coralview	p1010107	sea plume?				
Utila	Coralview	p1010108	Gorgonia ventalina				
Utila	Coralview	p1010487	colpophylla natans	112	67		
Utila	Coralview	p1010489	Porites porites				
Utila	Coralview	p1010490	Porites porites				
Utila	Coralview	p1010491	Porites porites				
Utila	Coralview	p1010492	Porites asteroides	55	31		
Utila	Coralview	p1010499	Porites asteroides	301	78		
Utila	Coralview	p1010501	Agaricia agaricites	79	36		
Utila	Coralview	p1010502	Agaricia agaricites	78	51		
Utila	Coralview	p1010503	Agaricia agaricites	14	14		
Utila	Coralview	p1010504	Agaricia agaricites	34	24		
Utila	Coralview	p1010506	Agaricia agaricites	168	50		
Utila	Coralview	p1010510	Agaricia agaricites	20	18		
Utila	Coralview	p1010510	Agaricia agaricites	16	15		
Utila	Coralview	p1010511	Siderastrea siderea	119	45		

Utila	Coralview	p1010513	Mycetophyllia lamarckiana	63	66		
Utila	Coralview	p1010514	Agaricia agaricites	23	20		
Utila	Coralview	p1010515	Agaricia agaricites	11	13		
Utila	Coralview	p1010517	Agaricia agaricites	82	54		
Utila	Coralview	p1010518	Agaricia agaricites	14	16		
Utila	Coralview	p1010520	Meandrina meandrites	104	43		
Utila	Coralview	p1010521	Agaricia agaricites	73	34		
Utila	Coralview	p1010524	Agaricia humilis	9	11		
Utila	Coralview	p1010527	Agaricia agaricites	48	32		
Utila	Coralview	p1010531	Siderastrea radians	20	22		
Utila	Coralview	p1010533	Diploria labyrinthiformis	139	64		
Utila	Coralview	p1010536	Madracis pharensis				
Utila	Coralview	p1010538	Montastrea annularis	107	49		
Utila	Coralview	p1010539	Agaricia agaricites	80	39		
Utila	Coralview	p1010542	Agaricia agaricites	7	10		
Utila	Coralview	p1010543	Montastrea faveolata	67	34		
Utila	Coralview	p1010544	Montastrea faveolata	12	17		
Utila	Coralview	p1010550	Porites porites				
Utila	Coralview	p1010551	Agaricia agaricites	137	66		
Utila	Coralview	p1010553	Agaricia humilis	14	13		
Utila	Coralview	p1010554	Agaricia humilis	57	29		
Utila	Coralview	p1010558	Agaricia humilis	87	54		
Utila	Coralview	p1010559	Agaricia agaricites	4	8		
Utila	Coralview	p1010561	Agaricia agaricites	78	41		
Utila	Coralview	p1010563	Porites asteroides	18	19		
Utila	Coralview	p1010566	Porites asteroides	30	27		
Utila	Coralview	p1010568	Agaricia agaricites	38	28		
Utila	Coralview	p1010569	Madracis decactis?	11	13		
Utila	Coralview	p1010570	Agaricia agaricites	4	8		
Utila	Coralview	p1010572	Agaricia agaricites	6	11		
Utila	Coralview	p1010574	Agaricia humilis	41	24		
Utila	Coralview	p1010578	Agaricia humilis	40	41		
Utila	Coralview	p1010579	Agaricia agaricites	19	20		

Utila	Coralview	p1010581	agaricia humilis	5	9		
Utila	Coralview	p1010582	Agaricia humilis	10	12		
Utila	Coralview	p1010585	Meandrina meandrites	32	21		
Utila	IronBound	p1010354	montastrea annularis	44	25		
Utila	IronBound	p1010355	montastrea annularis	127	44		
Utila	IronBound	p1010358	montastrea annularis	296	84		
Utila	IronBound	p1010359A	Diploria labyrinthiformis	105	46		
Utila	IronBound	p1010359B	Diploria labyrinthiformis	58	48		
Utila	IronBound	p1010359C	Diploria labyrinthiformis	5	9		
Utila	IronBound	p1010362	montastrea cavernosa	493	89		
Utila	IronBound	p1010364	diploria strigosa	312	67		
Utila	IronBound	p1010368	agaricia agaricites	104	39		
Utila	IronBound	p1010369	Dichocoenia stokesi	15	14		
Utila	IronBound	p1010370	isophyllia sinuosa	80	54		
Utila	IronBound	p1010372A	montastrea annularis	47	33		
Utila	IronBound	p1010372B	montastrea annularis	15	14		
Utila	IronBound	p1010374	montastrea annularis	53	30		
Utila	IronBound	p1010376	agaricia agaricites	71	32		
Utila	IronBound	p1010377	agaricia agaricites	3	7		
Utila	IronBound	p1010379	agaricia humilis	39	32		
Utila	IronBound	p1010381A	diploria	12	13		
Utila	IronBound	p1010381B	agaricia humilis	18	16		
Utila	IronBound	p1010383	agraricia agaricites	6	17		
Utila	IronBound	p1010385	montastrea annularis	6	11		
Utila	IronBound	p1010386	montastrea annularis	11	13		
Utila	JackNeil's	p1010434	Agaricia agaricites	122	60		
Utila	JackNeil's	p1010436	agaricia humilis	28	21		
Utila	JackNeil's	p1010440	Agaricia agaricites	86	47		
Utila	JackNeil's	p1010443	Agaricia humilis	17	16		
Utila	JackNeil's	p1010446	Agaricia agaricites	12	13		
Utila	JackNeil's	p1010449	Montastrea faveolata	246	90		
Utila	JackNeil's	p1010451	Montastrea faveolata	66	35		
Utila	JackNeil's	p1010452	madracis decactis	83	63		

Utila	JackNeil's	p1010456	??????????????				
Utila	JackNeil's	p1010458	Agaricia fragilis	323	93		
Utila	JackNeil's	p1010460	Agaricia agaricites	52	27		
Utila	JackNeil's	p1010461	montastrea franksi	65	30		
Utila	JackNeil's	p1010464	montastera cavernosa	93	39		
Utila	JackNeil's	p1010465	montastrea annularis	10	15		
Utila	JackNeil's	p1010468	montastrea annularis	25	19		
Utila	JackNeil's	p1010469	montastrea annularis	15	14		
Utila	JackNeil's	p1010471	montastrea annularis	15	17		
Utila	JackNeil's	p1010473	??? Same as 472	76	41		
Utila	JackNeil's	p1010474	Agaricia agaricites	114	58		
Utila	JackNeil's	p1010478	agaricia humilis	55	28		
Utila	JackNeil's	p1010481	Agaricia grahamae	20	22		
Utila	JackNeil's	p1010485	Gorgonia mariae				
Utila	JackNeil's	p1010589	montastrea faveolata	139	103		
Utila	JackNeil's	p1010590	agaricia humilis	21	18		
Utila	JackNeil's	p1010591	agaricia lamarcki	330	71		
Utila	JackNeil's	p1010593	agaricia agaricties	121	51		
Utila	JackNeil's	p1010595	montastrea faveolata	7	11		
Utila	Lighthouse	p1010004	agaricia agaricites	84	35		
Utila	Lighthouse	p1010005	montastrea faveolata	6	10		
Utila	Lighthouse	p1010006	montastrea faveolata	6	10		
Utila	Lighthouse	p1010007	agaricia agaricites	31	24		
Utila	Lighthouse	p1010013	madracis senaria	4	14		
Utila	Lighthouse	p1010014	agaricia agaricites	19	23		
Utila	Lighthouse	p1010015	porites porites	10	13		
Utila	Lighthouse	p1010017	montastrea faveolata	50	31		
Utila	Lighthouse	p1010020	agaricia agaricites	117	41		
Utila	Lighthouse	p1010021	agaricia agaricites	110	53		
Utila	Lighthouse	p1010022	siderastrea siderea	111	43		
Utila	Lighthouse	p1010023	gorgonian				
Utila	Lighthouse	p1010024	gorgonian				
Utila	Lighthouse	p1010026	gorgonian				

Utila	Lighthouse	p1010027	gorgonian				
Utila	Lighthouse	p1010029	gorgonian				
Utila	Lighthouse	p1010030	gorgonian				
Utila	Lighthouse	p1010032	gorgonian				
Utila	Lighthouse	p1010033	gorgonian				
Utila	Lighthouse	p1010035	gorgonian				
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Utila	Lighthouse	p1010627	montastrea faveolata	98	45		
Utila	Lighthouse	p1010628	agaricia humilis	90	43		
Utila	Lighthouse	p1010629	montastrea cavernosa	418	97		
Utila	Lighthouse	p1010631	madracis senaria	132	90		
Utila	Lighthouse	p1010632	agaricia humilis	12	13		
Utila	Lighthouse	p1010633	agaricia humilis	27	20		
Utila	Lighthouse	p1010634	agaricia agaricites	22	20		
Utila	Lighthouse	p1010636	agaricia fragilis	3	8		
Utila	Lighthouse	p1010637	madracis senaria	69	42		
Utila	Lighthouse	p1010638	agaricia fragilis	11	14		
Utila	Lighthouse	p1010641	agaricia agaricites	93	56		
Utila	Lighthouse	p1010642	agaricia agaricites	30	22		
Utila	Lighthouse	p1010644	agaricia fragilis	20	17		
Utila	Lighthouse	p1010645	montastrea annularis	35	24		
Utila	Lighthouse	p1010646	montastrea annularis	18	16		
Utila	Lighthouse	p1010647	agaricia agaricites	63	32		
Utila	Lighthouse	p1010648	agaricia agaricites	13	16		
Utila	Lighthouse	p1010649	porites asteroides	23	18		
Utila	Lighthouse	p1010650	montastrea annularis	57	29		
Utila	Lighthouse	p1010651	porites asteroides	38	24		
Utila	Lighthouse	p1010652	porites porites	124	51		
Utila	Lighthouse	p1010653	montastrea annularis	115	52		
Utila	Lighthouse	p1010655	montastrea annularis	2	5		
Utila	Lighthouse	p1010656	agaricia agaricites	11	4		
Utila	Lighthouse	p1010657	madracis formosa	5	11		
Utila	Lighthouse	p1010658	montastrea annularis	20	18		

Utila	Lighthouse	p1010661	montastrea faveolata	43	24		
Utila	Lighthouse	p1010662	montastrea faveolata	67	35		
Utila	Lighthouse	p1010663	montastrea faveolata	120	48		
Utila	Lighthouse	p1010664	montastrea faveolata	355	100		
Utila	Lighthouse	p1010665	montastrea faveolata	48	31		
Utila	Lighthouse	p1010666	montastrea faveolata	26	23		
Utila	Lighthouse	p1010667	montastrea faveolata	82	45		
Utila	Lighthouse	p1010668	montastrea faveolata	101	44		
Utila	LittleBight	p1010167	montastrea cavernosa	446	85		
Utila	LittleBight	p1010170	porites furcata			12	8
Utila	LittleBight	p1010172	agaricia agaricites	122	55		
Utila	LittleBight	p1010174	agaricia agaricites	19	20		
Utila	LittleBight	p1010176	Stephanocoenia intersepta	80	36		
Utila	LittleBight	p1010177	agaricia humilis	10	13		
Utila	LittleBight	p1010180	agaricia agaricites	127	66		
Utila	LittleBight	p1010182	agaricia agaricites	29	25		
Utila	LittleBight	p1010184	agaricia agaricites	15	15		
Utila	LittleBight	p1010186	montastrea faveolata	150	49		
Utila	LittleBight	p1010187	montastrea faveolata	302	75		
Utila	LittleBight	p1010190	agaricia agaricites	85	37		
Utila	LittleBight	p1010194	montastrea faveolata	267	80		
Utila	LittleBight	p1010196	montastrea faveolata	31	23		
Utila	LittleBight	p1010197	montastrea faveolata	76	33		
Utila	LittleBight	p1010198	montastrea faveolata	123	45		
Utila	LittleBight	p1010200	montastrea faveolata	153	93		
Utila	LittleBight	p1010202	montastrea faveolata	82	44		
Utila	LittleBight	p1010204	montastrea faveolata	41	28		
Utila	LittleBight	p1010205	montastrea annularis	48	31		
Utila	LittleBight	p1010206	montastrea annularis	158	91		
Utila	LittleBight	p1010207	gorgonia ventilana				
Utila	LittleBight	p1010209	millepora alcicornis				
Utila	LittleBight	p1010210	sea finger??				
Utila	LittleBight	p1010213	gorgonian				

Utila	LittleBight	p1010214	millepora alcicornis				
Utila	LittleBight	p1010217	gorgonian	44			
Utila	Slumberland	p1010131	agaricia grahamae (unusua	27	24		
Utila	Slumberland	p1010132	siderastrea siderea	259	70		
Utila	Slumberland	p1010134	solenastrea bourboni	34	23		
Utila	Slumberland	p1010135	porites porites				
Utila	Slumberland	p1010136	agaricia humilis	51	35		
Utila	Slumberland	p1010137A	agaricia agaricites	13	15		
Utila	Slumberland	p1010137B	agaricia agaricites	1	4		
Utila	Slumberland	p1010138	montastrea annularis	145	50		
Utila	Slumberland	p1010139	montastrea annularis	43	28		
Utila	Slumberland	p1010140	montastrea annularis	43	37		
Utila	Slumberland	p1010141	montastrea annularis	43	24		
Utila	Slumberland	p1010142	montastrea annularis	45	25		
Utila	Slumberland	p1010143	montastrea annularis	21	17		
Utila	Slumberland	p1010143	montastrea annularis	13	13		
Utila	Slumberland	p1010144	montastrea annularis	19	19		
Utila	Slumberland	p1010145	montastrea annularis	43	32		
Utila	Slumberland	p1010146	montastrea annularis	87	47		
Utila	Slumberland	p1010148	montastrea annularis	4	7		
Utila	Slumberland	p1010149	porites asteroides	96	43		
Utila	Slumberland	p1010150	montastrea faveolata	23	18		
Utila	Slumberland	p1010151	montastrea faveolata	8	11		
Utila	Slumberland	p1010152	montastrea faveolata	68	24		
Utila	Slumberland	p1010153	porites asteroides	49	29		
Utila	Slumberland	p1010154	?	1	4		
Utila	Slumberland	p1010155	montastrea faveolata	40	29		
Utila	Slumberland	p1010156	montastrea faveolata	35	26		
Utila	Slumberland	p1010157	montastrea faveolata	57	32		
Utila	Slumberland	p1010158	montastrea faveolata	15	18		
Utila	Slumberland	p1010159	madracis senaria				
Utila	Slumberland	p1010160	montastrea faveolata	52	32		
Utila	Slumberland	p1010161	montastrea faveolata	54	55		

Utila	Slumberland	p1010163	montastrea faveolata	13	15		
Utila	Slumberland	p1010164	montastrea faveolata	14	16		
Utila	Slumberland	p1010165	agaricia agaricites	18	19		
Utila	Slumberland	p1010171	gorgonian				
Utila	Slumberland	p1010173	gorgonian				
Utila	Slumberland	p1010174	gorgonian				
Utila	Slumberland	p1010175	agaricia agaricites	12	13		
Utila	Stingray Alley	p1010254	agaricia agaricites	7	12		
Utila	Stingray Alley	p1010257	agaricia agaricites	125	52		
Utila	Stingray Alley	p1010262	agaricia agaricites	71	32		
Utila	Stingray Alley	p1010263A	porites asteroides	20	21		
Utila	Stingray Alley	p1010263B	porites asteroides	2	6		
Utila	Stingray Alley	p1010265A	agaricia agaricites	5	8		
Utila	Stingray Alley	p1010265B	agaricia agaricites	1	4		
Utila	Stingray Alley	p1010267	agaricia agaricites	3	7		
Utila	Stingray Alley	p1010268	agaricia agaricites	6	11		
Utila	Stingray Alley	p1010271	agaricia agaricites	111	14		
Utila	Stingray Alley	p1010273A	agaricia agaricites	28	20		
Utila	Stingray Alley	p1010273B	agaricia agaricites	11	13		
Utila	Stingray Alley	p1010274	agaricia agaricites	22	18		
Utila	Stingray Alley	p1010275	agaricia agaricites	6	14		
Utila	Stingray Alley	p1010276	agaricia agaricites	91	47		
Utila	Stingray Alley	p1010277	agaricia agaricites	11	15		
Utila	Stingray Alley	p1010278	agaricia agaricites	19	16		
Utila	Stingray Alley	p1010280	agaricia agaricites	13	14		
Utila	Stingray Alley	p1010281	Sponge - Cliona carribea				
Utila	Stingray Alley	p1010282	agaricia agaricites	18	22		
Utila	Stingray Alley	p1010285	diploria strigosa	no	ruler		
Utila	Stingray Alley	p1010287	porites porites			21	15
Utila	Stingray Alley	p1010288	montastrea faveolata	66	31		
Utila	Stingray Alley	p1010289	montastrea annularis	14	15		
Utila	Stingray Alley	p1010292	agaricia fragilis	113	75		
Utila	Stingray Alley	p1010293	impossible ???				

Utila	Stingray Alley	p1010294	agaricia agaricites	5	9		
Utila	Stingray Alley	p1010295	montastrea annularis	148	47		
Utila	Stingray Alley	p1010296	montastrea annularis	no	ruler		
Utila	Stingray Alley	p1010299	montastrea annularis	70	32		
Utila	Stingray Alley	p1010301	montastrea annularis	34	23		
Utila	Stingray Alley	p1010302	montastrea annularis	47	25		
Utila	Stingray Alley	p1010303	montastrea annularis	50	29		
Utila	Stingray Alley	p1010304	montastrea annularis	20	17		
Utila	Stingray Alley	p1010306	montastrea annularis	28	19		
Utila	Stingray Alley	p1010307	agaricia agaricites	6	9		
Utila	Stingray Alley	p1010312	octocoral				
Utila	Stingray Alley	p1010314	gorgonian				
Utila	Stingray Alley	p1010315	octocoral				
Utila	Stingray Alley	p1010316	octocoral				
Utila	Stingray Alley	p1010317	octocoral				
Utila	Stingray Alley	p1010318	octocoral				
Utila	Stingray Alley	p1010319	octocoral				
Utila	Stingray Alley	p1010322	gorgonian				
Utila	Stingray Alley	p1010327	octocoral				
Utila	Stingray Alley	p1010330	millepora alcicornis				
Utila	Stingray Alley	p1010331	octocoral				
Utila	Stingray Point	p1010040	diploria labyrinthiformis	660	113		
Utila	Stingray Point	p1010041	montastrea annularis	16	15		
Utila	Stingray Point	p1010042	porites porites	14	16		
Utila	Stingray Point	p1010045	montastrea annularis	no	scale		
Utila	Stingray Point	p1010046	montastrea faveolata	13	14		
Utila	Stingray Point	p1010048	porites divaricata			19	13
Utila	Stingray Point	p1010049	millepora alcicornis				
Utila	Stingray Point	p1010050	porites divaricata			23	14
Utila	Stingray Point	p1010051	madracis mirabilis	8			
Utila	Stingray Point	p1010052	agaricia agaricites	35	23		
Utila	Stingray Point	p1010053	porites porites	8	11		
Utila	Stingray Point	p1010054	porites divaricata	22	15		

Utila	Stingray Point	p1010055	agaricia agaricites	30	23		
Utila	Stingray Point	p1010056	agaricia agaricites	6	10		
Utila	Stingray Point	p1010057	porites porites	5	9		
Utila	Stingray Point	p1010058	sea rod				
Utila	Stingray Point	p1010059	porites asteroides	11	13		
Utila	Stingray Point	p1010060	porites porites	12	15		
Utila	Stingray Point	p1010061	montastrea faveolata	19	20		
Utila	Stingray Point	p1010062	Dichocoenia stokesii	13	16		
Utila	Stingray Point	p1010062	Dichocoenia stokesii	14	15		
Utila	Stingray Point	p1010063	Dichocoenia stokesii	19	17		
Utila	Stingray Point	p1010064	montastrea faveolata	186	58		
Utila	Stingray Point	p1010065	gorgonian				
Utila	Stingray Point	p1010069	millepora alcicornis				
Utila	Stingray Point	p1010070	plexaurella nutans				
Utila	Stingray Point	p1010073	sea rod				
Utila	Stingray Point	p1010074	gorgonian				
Utila	Stingray Point	p1010078	gorgonian				
Utila	West End	p1010066	agaricia agaricites	130	50		
Utila	West End	p1010067	agaricia agaricites	20	17		
Utila	West End	p1010068	montastrea faveolata	44	28		
Utila	West End	p1010070	montastrea annularis	211	58		
Utila	West End	p1010073	montastrea franksi	82	45		
Utila	West End	p1010075	agaricia agaricites	54	32		
Utila	West End	p1010077	agaricia agaricites	97	44		
Utila	West End	p1010079	agaricia agaricites	80	35		
Utila	West End	p1010080	agaricia agaricites	40	32		
Utila	West End	p1010082	madracis formosa	5	10		
Utila	West End	p1010086	agaricia agaricites	273	63		
Utila	West End	p1010087	agaricia agaricites	65	35		
Utila	West End	p1010090	helioseries cucullata	100	62		
Utila	West End	p1010091	montastrea annularis	49	26		
Utila	West End	p1010092	montastrea annularis	47	30		
Utila	West End	p1010093	montastrea annularis	56	37		

Utila	West End	p1010094	montastrea annularis	117	45		
Utila	West End	p1010095	montastrea annularis	58	29		
Utila	West End	p1010096	montastrea annularis	191	88		
Utila	West End	p1010097	montastrea annularis	11	21		
Utila	West End	p1010098	montastrea annularis	34	33		
Utila	West End	p1010099	montastrea annularis	33	21		
Utila	West End	p1010100	montastrea annularis	148	98		
Utila	West End	p1010101	montastrea annularis	49	47		
Utila	West End	p1010102	montastrea annularis	52	36		
Utila	West End	p1010103	montastrea annularis	149	53		
Utila	West End	p1010104	montastrea annularis	34	22		
Utila	West End	p1010106	agaricia agaricites	7	10		
Utila	West End	p1010107	porites porites	30	26		
Utila	West End	p1010108	sea rod				
Utila	West End	p1010109	gorgonian				
Utila	West End	p1010111	sea rod (knobby)				
Utila	West End	p1010112	gorgonian				
Utila	West End	p1010114	sea rod				
Utila	West End	p1010115	octocoral				
Utila	West End	p1010116	octocoral				
Utila	West End	p1010118	gorgonian				
Utila	West End	p1010119	octocoral				
Utila	West End	p1010120	octocoral				
	Stingray Alley	p1010266	agaricia humilis	27	20		

Reef	Site	Image file	Genus/Species	Size cm2	Periphery cm	Height	Width
Cayos Cochinos	Arena 1	p1010465	montastrea annularis	46	51		
Cayos Cochinos	Arena 1	p1010466	montastrea annularis	29	28		
Cayos Cochinos	Arena 1	p1010466	montastrea annularis	20	21		
Cayos Cochinos	Arena 1	p1010468	montastrea annularis	25	19		
Cayos Cochinos	Arena 1	p1010470	millepora alcicornis	61	57		
Cayos Cochinos	Arena 1	p1010471	millepora alcicornis			13	
Cayos Cochinos	Arena 1	p1010473	millepora alcicornis			18	6
Cayos Cochinos	Arena 1	p1010474	millepora alcicornis			44	54
Cayos Cochinos	Arena 1	p1010475	porites asteroides	136	59		
Cayos Cochinos	Arena 1	p1010476	Mycetophyllia lamarckiana	136	57		
Cayos Cochinos	Arena 1	p1010477	porites asteroides	137	50		
Cayos Cochinos	Arena 1	p1010480	porites asteroides	334	74		
Cayos Cochinos	Arena 1	p1010481	porites asteroides	300	72		
Cayos Cochinos	Arena 1	p1010483	montastrea annularis	22	3		
Cayos Cochinos	Arena 1	p1010484	montastrea annularis	12	21		
Cayos Cochinos	Arena 1	p1010485	agaricia agaricites	309	81		
Cayos Cochinos	Arena 1	p1010486	agaricia agaricites	129	56		
Cayos Cochinos	Arena 1	p1010487	montastrea franksi	41	38		
Cayos Cochinos	Arena 1	p1010488	agaricia agaricites	5	9		
Cayos Cochinos	Arena 1	p1010489	agaricia agaricites	10	13		
Cayos Cochinos	Arena 1	p1010490A	montastrea franksi	59	37		
Cayos Cochinos	Arena 1	p1010490B	montastrea franksi	3	6		
Cayos Cochinos	Arena 1	p1010494	gorgonian			43	57
Cayos Cochinos	Arena 1	p1010495	gorgonian			14	9
Cayos Cochinos	Arena 1	p1010496	gorgonian			18	3
Cayos Cochinos	Arena 1	p1010497	gorgonian			27	
Cayos Cochinos	Arena 1	p1010498	agaricia agaricites	28	24		
Cayos Cochinos	Arena 1	p1010499	millepora alcicornis			30	
Cayos Cochinos	Arena 1	p1010500	gorgonian			40	24
Cayos Cochinos	Arena 1	p1010501	gorgonian			10	
Cayos Cochinos	Arena 1	p1010502	millepora alcicornis			13	

Cayos Cochinos	Arena 1	p1010503	gorgonian			15	
Cayos Cochinos	Arena 1	p1010504	pseudopterogorgia bipinnata			5	
Cayos Cochinos	Arena 1	p1010505	gorgonian			23	23
Cayos Cochinos	Arena 1	p1010506	gorgonian			9	8
Cayos Cochinos	Arena 1	p1010507	gorgonian			6	
Cayos Cochinos	Arena 1	p1010508	gorgonian			7	9
Cayos Cochinos	Arena 1	p1010509	gorgonian			48	
Cayos Cochinos	Arena 1	p1010510	gorgonian			12	
Cayos Cochinos	Arena 1	p1010511	gorgonian			11	
Cayos Cochinos	Arena 1	p1010512	gorgonian			25	
Cayos Cochinos	Arena 1	p1010513	gorgonian			29	
Cayos Cochinos	Arena 1	p1010514	gorgonian			19	
Cayos Cochinos	Arena 1	p1010515	mycetophyllia ferox	no scale			
Cayos Cochinos	Arena 1	p1010518	agaricia humilis	65	38		
Cayos Cochinos	Arena 2	p1010725	montastrea annularis	45	37		
Cayos Cochinos	Arena 2	p1010726	montastrea annularis	61	34		
Cayos Cochinos	Arena 2	p1010726	montastrea annularis	12	14		
Cayos Cochinos	Arena 2	p1010727	montastrea annularis	31	37		
Cayos Cochinos	Arena 2	p1010728	montastrea annularis	116	60		
Cayos Cochinos	Arena 2	p1010729	montastrea annularis	19	21		
Cayos Cochinos	Arena 2	p1010730	montastrea annularis	24	30		
Cayos Cochinos	Arena 2	p1010730	montastrea annularis	15	17		
Cayos Cochinos	Arena 2	p1010731	montastrea annularis	65	31		
Cayos Cochinos	Arena 2	p1010732	montastrea annularis	110	44		
Cayos Cochinos	Arena 2	p1010733	montastrea annularis	42	26		
Cayos Cochinos	Arena 2	p1010733	montastrea annularis	4	9		
Cayos Cochinos	Arena 2	p1010734	montastrea annularis	49	45		
Cayos Cochinos	Arena 2	p1010735	montastrea annularis	49	36		
Cayos Cochinos	Arena 2	p1010736	montastrea annularis	8	11		
Cayos Cochinos	Arena 2	p1010738	montastrea annularis	29	24		
Cayos Cochinos	Arena 2	p1010739	montastrea annularis	40	33		
Cayos Cochinos	Arena 2	p1010740	montastrea faveolata	39	25		
Cayos Cochinos	Arena 2	p1010740	montastrea faveolata	2	6		

Cayos Cochinos	Arena 2	p1010742	mycetophyllia danaana	36	24		
Cayos Cochinos	Arena 2	p1010743	agaricia agaricites	13	14		
Cayos Cochinos	Arena 2	p1010744	agaricia agaricites	86	35		
Cayos Cochinos	Arena 2	p1010745	agaricia agaricites	35	22		
Cayos Cochinos	Arena 2	p1010746	agaricia agaricites	20	17		
Cayos Cochinos	Arena 2	p1010748	agaricia agaricites	185	68		
Cayos Cochinos	Arena 2	p1010749	agaricia agaricites	37	26		
Cayos Cochinos	Arena 2	p1010750	agaricia agaricites	36	23		
Cayos Cochinos	Arena 2	p1010751	montastrea franksi	62	38		
Cayos Cochinos	Arena 2	p1010752	agaricia agaricites	12	13		
Cayos Cochinos	Arena 2	p1010753	gorgonian			35	
Cayos Cochinos	Arena 2	p1010754	gorgonian			10	
Cayos Cochinos	Arena 2	p1010755	agaricia agaricites	3	7		
Cayos Cochinos	Arena 2	p1010756	gorgonian			6	3
Cayos Cochinos	Arena 2	p1010757	gorgonian			17	5
Cayos Cochinos	Arena 2	p1010758	gorgonian			26	9
Cayos Cochinos	Arena 2	p1010760	gorgonian			20	18
Cayos Cochinos	Arena 2	p1010761	gorgonian			23	11
Cayos Cochinos	Arena 2	p1010762	gorgonian			29	
Cayos Cochinos	Arena 2	p1010763	gorgonian			12	
Cayos Cochinos	Arena 2	p1010764	agaricia agaricites	22	22		
Cayos Cochinos	Arena 2	p1010765	monstatrea faveolata	36	27		
Cayos Cochinos	Arena 2	p1010766	montastrea faveolata	21	24		
Cayos Cochinos	Peli 2.5	p1010544	agaricia fragilis	134	45		
Cayos Cochinos	Peli 2.5	p1010545	agaricia fragilis	90	38		
Cayos Cochinos	Peli 2.5	p1010546	agaricia fragilis	139	64		
Cayos Cochinos	Peli 2.5	p1010547	mycetophyllia ferox	28	22		
Cayos Cochinos	Peli 2.5	p1010549	agaricia agaricites	573	106		
Cayos Cochinos	Peli 2.5	p1010550	agaricia agaricites	101	57		
Cayos Cochinos	Peli 2.5	p1010551	agaricia agaricites	18	19		
Cayos Cochinos	Peli 2.5	p1010553	agaricia agaricites	20	17		
Cayos Cochinos	Peli 2.5	p1010554	agaricia agaricites	4	8		
Cayos Cochinos	Peli 2.5	p1010556	agaricia agaricites	108	51		

Cayos Cochinos	Peli 2.5	p1010557	agaricia agaricites	43	28		
Cayos Cochinos	Peli 2.5	p1010559	porites asteroides	39	42		
Cayos Cochinos	Peli 2.5	p1010560	agaricia fragilis	71	33		
Cayos Cochinos	Peli 2.5	p1010561	gorgonian			26	11
Cayos Cochinos	Peli 2.5	p1010562	gorgonian			18	17
Cayos Cochinos	Peli 2.5	p1010563	gorgonian			12	6
Cayos Cochinos	Peli 2.5	p1010564	gorgonian			13	6
Cayos Cochinos	Peli 2.5	p1010565	gorgonian			8	18
Cayos Cochinos	Peli 2.5	p1010567	gorgonian			20	18
Cayos Cochinos	Peli 2.5	p1010568	gorgonian			6	5
Cayos Cochinos	Peli 2.5	p1010570	pseudopterogorgia bipinnata			18	12
Cayos Cochinos	Peli 2.5	p1010571	gorgonia sp.			16	11
Cayos Cochinos	Peli 2.5	p1010572	gorgonian			8	11
Cayos Cochinos	Peli 2.5	p1010573	pseudopterogorgia bipinnata			7	5
Cayos Cochinos	Peli0 1	1	agaricia agaricites	97	54		
Cayos Cochinos	Peli0 1	2	montastrea annularis	14	18		
Cayos Cochinos	Peli0 1	2	montastrea annularis	18	26		
Cayos Cochinos	Peli0 1	2	montastrea annularis	68	47		
Cayos Cochinos	Peli0 1	3	montastrea annularis	211	68		
Cayos Cochinos	Peli0 1	3	montastrea annularis	29	21		
Cayos Cochinos	Peli0 1	3	montastrea annularis	42	26		
Cayos Cochinos	Peli0 1	3	montastrea annularis	33	21		
Cayos Cochinos	Peli0 1	3	montastrea annularis	20	17		
Cayos Cochinos	Peli0 1	4	montastrea annularis	94	48		
Cayos Cochinos	Peli0 1	6	montastrea annularis	97	30		
Cayos Cochinos	Peli0 1	7	agaricia agaricites	38	24		
Cayos Cochinos	Peli0 1	8	madracis decactis	90	50		
Cayos Cochinos	Peli0 1	9	porites asteroides	28	21		
Cayos Cochinos	Peli0 1	10	montastrea cavernosa	170	55		
Cayos Cochinos	Peli0 1	11	monstatrea annularis	48	33		
Cayos Cochinos	Peli0 1	12	montastrea cavernosa	65	31		
Cayos Cochinos	Peli0 1	13	agaricia agaricites	75	56		
Cayos Cochinos	Peli0 1	14	monstatrea annularis	98	73		

Cayos Cochinos	Peli0 1	15	manicina areolata	65	38		
Cayos Cochinos	Peli0 1	17	montastrea cavernosa	70	35		
Cayos Cochinos	Peli0 1	18	gorgonian			42	35
Cayos Cochinos	Peli0 1	5A	montastrea annularis	93	50		
Cayos Cochinos	Peli0 1	5B	montastrea annularis	24	20		
Cayos Cochinos	Peli0 2	p1010824	monstatrea annularis	67	38		
Cayos Cochinos	Peli0 2	p1010825	monstatrea annularis	20	20		
Cayos Cochinos	Peli0 2	p1010827	agaricia agaricites	247	98		
Cayos Cochinos	Peli0 2	p1010828	agaricia agaricites	155	71		
Cayos Cochinos	Peli0 2	p1010829	madracis decactis	143	53		
Cayos Cochinos	Peli0 2	p1010831	agaricia agaricites	26	21		
Cayos Cochinos	Peli0 2	p1010832	madracis decactis	48	34		
Cayos Cochinos	Peli0 2	p1010833A	montastrea cavernosa	9	12		
Cayos Cochinos	Peli0 2	p1010833B	montastrea cavernosa	13	14		
Cayos Cochinos	Peli0 2	p1010834	montastrea annularis	24	22		
Cayos Cochinos	Peli0 2	p1010836	montastrea franksi	34	27		
Cayos Cochinos	Peli0 2	p1010837	agaricia agaricites	36	22		
Cayos Cochinos	Peli0 2	p1010838	agaricia agaricites	46	25		
Cayos Cochinos	Peli0 2	p1010839	monstatrea annularis	14	14		
Cayos Cochinos	Peli0 2	p1010840	monstatrea annularis	9	12		
Cayos Cochinos	Peli0 2	p1010841	monstatrea annularis	8	12		
Cayos Cochinos	Peli0 2	p1010842	madracis decactis	68	31		
Cayos Cochinos	Peli0 2	p1010843	agaricia humilis	3	6		
Cayos Cochinos	Peli0 2	p1010845A	montastrea annularis	4	15		
Cayos Cochinos	Peli0 2	p1010845B	montastrea annularis	21	19		
Cayos Cochinos	Peli0 2	p1010846	montastrea annularis	25	20		
Cayos Cochinos	Peli0 2	p1010847	montastrea annularis	34	22		
Cayos Cochinos	Peli0 2	p1010848	montastrea annularis	8	10		
Cayos Cochinos	Peli0 2	p1010849	montastrea annularis	88	59		
Cayos Cochinos	Peli0 2	p1010850	montastrea annularis	170	79		
Cayos Cochinos	Peli0 2	p1010850	montastrea annularis	8	1		
Cayos Cochinos	Peli0 2	p1010852	montastrea annularis	17	15		
Cayos Cochinos	Peli0 2	p1010852	montastrea annularis	19	17		

Cayos Cochinos	Peli0 2	p1010853	montastrea annularis	15	15		
Cayos Cochinos	Peli0 2	p1010853	montastrea annularis	20	18		
Cayos Cochinos	Peli0 2	p1010853	montastrea annularis	10	19		
Cayos Cochinos	Peli0 2	p1010856	montastrea annularis	21	18		
Cayos Cochinos	Peli0 2	p1010856	montastrea annularis	7	10		
Cayos Cochinos	Peli0 2	p1010857	montastrea annularis	28	23		
Cayos Cochinos	Peli0 2	p1010857	montastrea annularis	9	12		
Cayos Cochinos	Peli0 2	p1010857	montastrea annularis	21	17		
Cayos Cochinos	Peli0 2	p1010857	montastrea annularis	16	16		
Cayos Cochinos	Peli0 2	p1010858	montastrea annularis	31	27		
Cayos Cochinos	Peli0 2	p1010859	montastrea annularis	5	9		
Cayos Cochinos	Peli0 2	p1010860	montastrea annularis	22	24		
Cayos Cochinos	Peli0 2	p1010861	montastrea annularis	45	29		
Cayos Cochinos	Peli0 2	p1010862	montastrea annularis	35	22		
Cayos Cochinos	Peli0 2	p1010863	montastrea annularis	44	35		
Cayos Cochinos	Peli0 2	p1010864	montastrea annularis	34	26		
Cayos Cochinos	Peli0 2	p1010976	gorgonian			44	37
Cayos Cochinos	Peli0 2	p1010978	gorgonian			22	13
Cayos Cochinos	Peli0 2	p1010979	gorgonian			28	15
Cayos Cochinos	Peli0 2	p1010980	gorgonian			10	9
Cayos Cochinos	Peli0 2	p1010981	sea finger			12	
Cayos Cochinos	Peli0 2	p1010982	gorgonian			9	
Cayos Cochinos	Peli0 2	p1010983	gorgonian			48	27
Cayos Cochinos	Peli0 2	p1010984	gorgonian			13	8
Cayos Cochinos	Peli0 2	p1010986	agaricia agaricites	136	62		
Cayos Cochinos	Peli0 2	p1010987	siderastrea siderea	70	36		
Cayos Cochinos	Peli0 2	p1010988	agaricia grahamae	84	37		
Cayos Cochinos	Peli0 2	p1010990	agaricia grahamae	170	72		
Cayos Cochinos	Peli0 2	p1010992	montastrea annularis	42	24		
Cayos Cochinos	Peli2 1	p1010298	montastrea annularis	33	21		
Cayos Cochinos	Peli2 1	p1010299	montastrea annularis	38	24		
Cayos Cochinos	Peli2 1	p1010300	montastrea annularis	58	28		
Cayos Cochinos	Peli2 1	p1010301	montastrea annularis	83	40		

Cayos Cochinos	Peli2 1	p1010302	montastrea annularis	67	35		
Cayos Cochinos	Peli2 1	p1010303	montastrea annularis	27	19		
Cayos Cochinos	Peli2 1	p1010304	montastrea annularis	26	20		
Cayos Cochinos	Peli2 1	p1010305	montastrea annularis	32	20		
Cayos Cochinos	Peli2 1	p1010306	montastrea annularis	255	95		
Cayos Cochinos	Peli2 1	p1010307	montastrea annularis	245	71		
Cayos Cochinos	Peli2 1	p1010307	montastrea annularis	6	13		
Cayos Cochinos	Peli2 1	p1010308	montastrea annularis	15	15		
Cayos Cochinos	Peli2 1	p1010309	erythropodium caribaeorum				
Cayos Cochinos	Peli2 1	p1010311	agaricia agaricites	17	19		
Cayos Cochinos	Peli2 1	p1010312	Erythropodium caribaeoru	25	27		
Cayos Cochinos	Peli2 1	p1010313	Erythropodium caribaeoru	26	28		
Cayos Cochinos	Peli2 1	p1010314	agaricia humilis	2	6		
Cayos Cochinos	Peli2 1	p1010314	siderastrea siderea	4	8		
Cayos Cochinos	Peli2 1	p1010315	helioseris cucullata	39	27		
Cayos Cochinos	Peli2 1	p1010317	agaricia humilis	79	36		
Cayos Cochinos	Peli2 1	p1010318	agaricia fragilis	32	24		
Cayos Cochinos	Peli2 1	p1010319	montastrea	26	21		
Cayos Cochinos	Peli2 1	p1010320	gorgonian			12	9
Cayos Cochinos	Peli2 1	p1010321	gorgonian			12	8
Cayos Cochinos	Peli2 1	p1010322	gorgonian			12	9
Cayos Cochinos	Peli2 1	p1010323	gorgonian			8	7
Cayos Cochinos	Peli2 1	p1010324	gorgonian			9	
Cayos Cochinos	Peli2 1	p1010325	gorgonian			13	
Cayos Cochinos	Peli2 1	p1010326	gorgonian			9	9
Cayos Cochinos	Peli2 1	p1010327	gorgonian			7	13
Cayos Cochinos	Peli2 1	p1010328	gorgonian			11	7
Cayos Cochinos	Peli2 1	p1010330	gorgonian			9	10
Cayos Cochinos	Peli2 1	p1010331	gorgonian			12	9
Cayos Cochinos	Peli2 1	p1010332	gorgonian			9	3
Cayos Cochinos	Peli2 1	p1010333	gorgonian			13	
Cayos Cochinos	Peli2 2	p1010002	gorgonian			19	9
Cayos Cochinos	Peli2 2	p1010003	gorgonian			16	13

Cayos Cochinos	Peli2 2	p1010004	gorgonian			18	12
Cayos Cochinos	Peli2 2	p1010005	gorgonian			16	
Cayos Cochinos	Peli2 2	p1010006	gorgonian			20	
Cayos Cochinos	Peli2 2	p1010007	gorgonian			17	14
Cayos Cochinos	Peli2 2	p1010008	gorgonian			22	15
Cayos Cochinos	Peli2 2	p1010009	gorgonian			23	16
Cayos Cochinos	Peli2 2	p1010010	gorgonian			22	14
Cayos Cochinos	Peli2 2	p1010011	gorgonian			15	8
Cayos Cochinos	Peli2 2	p1010012	gorgonia mariae			8	7
Cayos Cochinos	Peli2 2	p1010013	gorgonian			14	12
Cayos Cochinos	Peli2 2	p1010014	pseudopterogorgia bipinnata			30	26
Cayos Cochinos	Peli2 2	p1010015	gorgonian			19	11
Cayos Cochinos	Peli2 2	p1010017	millepora			15	
Cayos Cochinos	Peli2 2	p1010019	gorgonian			29	22
Cayos Cochinos	Peli2 2	p1010020	pseudopterogorgia bipinnata			29	26
Cayos Cochinos	Peli2 2	p1010021	gorgonian			32	28
Cayos Cochinos	Peli2 2	p1010022	gorgonian			7	7
Cayos Cochinos	Peli2 2	p1010024	sea rod			32	13
Cayos Cochinos	Peli2 2	p1010026	gorgonian			11	10
Cayos Cochinos	Peli2 2	p1010027	pseudopterogorgia bipinnata			18	11
Cayos Cochinos	Peli2 2	p1010913	diploria strigosa	68	33		
Cayos Cochinos	Peli2 2	p1010914	isophylla sinuosa	216	59		
Cayos Cochinos	Peli2 2	p1010915	montastrea annularis	101	43		
Cayos Cochinos	Peli2 2	p1010916	montastrea annularis	14	14		
Cayos Cochinos	Peli2 2	p1010917	montastrea annularis	28	20		
Cayos Cochinos	Peli2 2	p1010918	montastrea annularis	13	14		
Cayos Cochinos	Peli2 2	p1010919	acropora celvicornis	14	34		
Cayos Cochinos	Peli2 2	p1010920	porites asteroides	45	28		
Cayos Cochinos	Peli2 2	p1010921	agaricia agaricites	49	30		
Cayos Cochinos	Peli2 2	p1010922	montastrea annularis	20	16		
Cayos Cochinos	Peli2 2	p1010923	montastrea annularis	20	17		
Cayos Cochinos	Peli2 2	p1010924	montastrea annularis	24	19		
Cayos Cochinos	Peli2 2	p1010925A	montastrea annularis	37	29		

Cayos Cochinos	Peli2 2	p1010925B	montastrea annularis	89	46		
Cayos Cochinos	Peli2 2	p1010925C	montastrea annularis	278	78		
Cayos Cochinos	Peli2 2	p1010926	montastrea annularis	31	25		
Cayos Cochinos	Peli2 2	p1010927	montastrea franksi	23	20		
Cayos Cochinos	Peli2 2	p1010928A	montastrea franksi	144	90		
Cayos Cochinos	Peli2 2	p1010928B	montastrea franksi	44	32		
Cayos Cochinos	Peli2 2	p1010929	montastrea annularis	18	16		
Cayos Cochinos	Peli2 2	p1010930A	montastrea annularis	43	27		
Cayos Cochinos	Peli2 2	p1010930B	montastrea annularis	8	11		
Cayos Cochinos	Peli2 2	p1010931	montastrea annularis	66	52		
Cayos Cochinos	Peli2 2	p1010932	montastrea annularis	67	36		
Cayos Cochinos	Peli2 2	p1010934	montastrea annularis	131	51		
Cayos Cochinos	Peli2 2	p1010935	montastrea faveolata	68	36		
Cayos Cochinos	Peli2 2	p1010936	porites asteroides	138	54		
Cayos Cochinos	Peli2 2	p1010938	montastrea faveolata	188	54		
Cayos Cochinos	Peli2 2	p1010939	montastrea faveolata	30	23		
Cayos Cochinos	Peli2 2	p1010940	montastrea faveolata	16	16		
Cayos Cochinos	Peli2 2	p1010941	agaricia agaricites	148	54		
Cayos Cochinos	Peli2 2	p1010943	agaricia agaricites	43	33		
Cayos Cochinos	Peli2 2	p1010944	agaricia agaricites	28	20		
Cayos Cochinos	Peli2 2	p1010945	agaricia agaricites	184	68		
Cayos Cochinos	Peli2 2	p1010946	montastrea faveolata	225	69		
Cayos Cochinos	Peli2 2	p1010947	helioseris cucullata	43	38		
Cayos Cochinos	Peli2 2	p1010949	montastrea annularis	119	41		
Cayos Cochinos	Peli2 2	p1010950	mycetophyllia lamarckiana	50	28		
Cayos Cochinos	Peli2 2	p1010951	montastrea faveolata	33	23		
Cayos Cochinos	Peli2 2	p1010952	mycetophyllia lamarckiana	7	11		
Cayos Cochinos	Peli2 2	p1010953	montastrea faveolata	43	25		
Cayos Cochinos	Peli2 2	p1010954	montastrea faveolata	38	25		
Cayos Cochinos	Peli2 2	p1010956	mycetophyllia lamarckiana	74	34		
Cayos Cochinos	Peli2 2	p1010957A	montastrea annularis	39	24		
Cayos Cochinos	Peli2 2	p1010957B	montastrea annularis	38	29		
Cayos Cochinos	Peli2 2	p1010957C	montastrea annularis	7	10		

Cayos Cochinos	Peli2 2	p1010958	montastrea annularis	175	53		
Cayos Cochinos	Peli2 2	p1010959	montastrea annularis	107	41		
Cayos Cochinos	Peli2 2	p1010960	montastrea annularis	81	35		
Cayos Cochinos	Peli2 2	p1010961	montastrea annularis	81	33		
Cayos Cochinos	Peli2 2	p1010962	montastrea annularis	56	29		
Cayos Cochinos	Peli2 2	p1010963	gorgonian			26	21
Cayos Cochinos	Peli2 2	p1010964	gorgonian			23	18
Cayos Cochinos	Peli2 2	p1010965	gorgonian			16	9
Cayos Cochinos	Peli2 2	p1010966	gorgonian			6	4
Cayos Cochinos	Peli2 2	p1010967	gorgonian			39	39
Cayos Cochinos	Peli2 2	p1010968	gorgonian			32	29
Cayos Cochinos	Peli2 2	p1010969	gorgonian			24	17
Cayos Cochinos	Peli2 2	p1010970	gorgonian			35	32
Cayos Cochinos	Peli2 2	p1010972	gorgonian			25	39
Cayos Cochinos	Timon	DSC 1199	porites asteroides	45	34		
Cayos Cochinos	Timon	DSC 1201	gorgonian	320	95		
Cayos Cochinos	Timon	p1010419	agaricia tenuifolia			37	31
Cayos Cochinos	Timon	p1010421	agaricia tenuifolia			17	13
Cayos Cochinos	Timon	p1010422	siderastrea siderea	240	84		
Cayos Cochinos	Timon	p1010423	siderastrea siderea	202	61		
Cayos Cochinos	Timon	p1010424	agaricia tenuifolia			29	30
Cayos Cochinos	Timon	p1010426	agaricia humilis	19	28		
Cayos Cochinos	Timon	p1010428	agaricia agaricites	63	37		
Cayos Cochinos	Timon	p1010430	siderastrea siderea	79	41		
Cayos Cochinos	Timon	p1010443	agaricia agaricites	32	21		
Cayos Cochinos	Timon	p1010444	agaricia agaricites	40	28		
Cayos Cochinos	Timon	p1010445	agaricia agaricites	21	25		
Cayos Cochinos	Timon	p1010446	siderastrea siderea	30	23		
Cayos Cochinos	Timon	p1010447	agaricia grahamae	118	55		
Cayos Cochinos	Timon	p1010449	porites asteroides	6	10		
Cayos Cochinos	Timon	p1010450	agaricia lamarcki	6	10		
Cayos Cochinos	Timon	p1010451	agaricia agaricites	20	19		
Cayos Cochinos	Timon	p1010452	porites asteroides	6	11		

Cayos Cochinos	Timon	p1010453	helioseris cucullata	127	47		
Cayos Cochinos	Timon	p1010454	agaricia tenuifolia			17	21
Cayos Cochinos	Timon	p1010456	gorgonian			9	8
Cayos Cochinos	Timon	p1010458	gorgonian			23	1
Cayos Cochinos	Timon	p1010459	gorgonian			12	7
Cayos Cochinos	Timon	p1010460	gorgonian			5	4
Cayos Cochinos	Timon	p1010461	gorgonian			24	16
Cayos Cochinos	Timon 2	p1010585	montastrea annularis	57	49		
Cayos Cochinos	Timon 2	p1010588	montastrea annularis	35	24		
Cayos Cochinos	Timon 2	p1010590	montastrea annularis	48	27		
Cayos Cochinos	Timon 2	p1010596	montastrea annularis	46	36		
Cayos Cochinos	Timon 2	p1010599	montastrea annularis	46	26		
Cayos Cochinos	Timon 2	p1010605	montastrea annularis	20	18		
Cayos Cochinos	Timon 2	p1010610	montastrea annularis	86	35		
Cayos Cochinos	Timon 2	p1010611	montastrea annularis	27	20		
Cayos Cochinos	Timon 2	p1010623	montastrea annularis	53	37		
Cayos Cochinos	Timon 2	p1010624	montastrea annularis	53	35		
Cayos Cochinos	Timon 2	p1010626	montastrea annularis	30	29		
Cayos Cochinos	Timon 2	p1010627	montastrea annularis	43	26		
Cayos Cochinos	Timon 2	p1010630	montastrea annularis	29	24		
Cayos Cochinos	Timon 2	p1010631	montastrea annularis	9	14		
Cayos Cochinos	Timon 2	p1010633	montastrea annularis	35	22		
Cayos Cochinos	Timon 2	p1010634	agaricia agaricites	2	6		
Cayos Cochinos	Timon 2	p1010638	montastrea annularis	24	20		
Cayos Cochinos	Timon 2	p1010639	montastrea annularis	5	9		
Cayos Cochinos	Timon 2	p1010640	madracis decactis				
Cayos Cochinos	Timon 2	p1010642A	agaricia agaricites	2	6		
Cayos Cochinos	Timon 2	p1010642B	madracis decactis	3	7		
Cayos Cochinos	Timon 2	p1010643	agaricia agaricites	10	18		
Cayos Cochinos	Timon 2	p1010644	solenastrea hyades	5	9		
Cayos Cochinos	Timon 2	p1010645	agaricia agaricites	4	7		
Cayos Cochinos	Timon 2	p1010646	agaricia humilis	22	17		
Cayos Cochinos	Timon 2	p1010647	montastrea annularis	5	11		

Cayos Cochinos	Timon 2	p1010650	agaricia agaricites	9	11		
Cayos Cochinos	Timon 2	p1010651	siderastrea siderea	10	12		
Cayos Cochinos	Timon 2	p1010654	montastrea annularis	36	26		
Cayos Cochinos	Timon 2	p1010658	montastrea annularis	24	19		
Cayos Cochinos	Timon 2	p1010659	montastrea annularis	63	45		
Cayos Cochinos	Timon 2	p1010663	montastrea annularis	78	38		
Cayos Cochinos	Timon 2	p1010669	gorgonian			19	13
Cayos Cochinos	Timon 2	p1010671	montastrea annularis	24	20		
Cayos Cochinos	Timon 2	p1010677	gorgonian			17	8
Cayos Cochinos	Timon 2	p1010678	gorgonian			13	10
Cayos Cochinos	Timon 2	p1010679	gorgonian			45	55
Cayos Cochinos	Timon 2	p1010680	gorgonian			6	8

% contact coral	Coral species	% contact sponge	sponge sp	% contact algae	Algae species	edge status	
				14	L/H/T	1	
		26	OI+black	11	D/L	2	
				22	Dictyota	2	
						3	
4	agaricia	10	sponge	25	D/H/T	3	
		11		47	D/J/T	2	
18	millepora			32	D/J/T	2	
18	millepora/agaricia			14	D/L/T	1	
12	millepora/agaricia			8	L	1	
64	millepora/agaricia			13	D	2	
				9	D	1	

				16	D/L/T	2	
				47	d/t	2	
				31	h/t	2	
				36	d/h	2	
4				24	d/t	2	
				75	d/l/h/t	1	
18				36	d/j/t	2	
				47	d/j	1	
12				14	D/L/J	2	
				56	J/L/T	3	
				9	H/D/L	2	
				33	D/J	2	
				31	D/H/L/T	2	
				32	D/T	2	
				29	D/H/J/T	1	
				23	D/H	3	
				37	D/J	2	
				47	D/J	2	
				39	J	2	
6	agaricia			32	H/J/T	2	
						1	
				19	H/L/T	2	
						3	
				13	L	2	
				36	D/H	1	
21	madracis					2	
54	agaricia			10	L	2	
				100	H/D/L/T	3	
		19		36	D/H	1	
				45	D/T	2	
				67	D	3	

				100	L/T	2	
				54	J/T	2	
				32	D/H/L/J/T	1	
						2	
				17	H	2	
				12	H/T	2	
				13	D/T	3	
				34	H/T	3	
						3	
				32	D/H/T	1	
20	cavernosa			13	H/T	2	
				23	H	2	
				45	H/T	1	
				31	D/J/T	2	
				22	H/L/T	2	
						2	
						2	
				30	H	2	
		17	purple	40	D/T	3	
3	millepora			36	H/L/D/J/T	3	
				42	H/D/J	2	
				39	H/D/J	2	
						3	
		100	sponge			3	
		100	sponge			3	
				40	H/D/J	2	
				60	H	3	
				57	D/H/J/T	2	
				57	D/H	2	
				64	D/H	2	
		26	red	22	D	2	
		27	red	17	H/J	2	
						2	

						2	
				34	H/D	1	
				14	H	1	
				34	D/L/J	1	
				39	J/T	2	
						2	
				30	D/H/T	1	
						1	
				25	D	2	
				32	D/H/L/	2	
				52	D/H/J	2	
		8	red	40	D/H	1	
				24	D/H	2	
		14	red	28	H/D	3	
		8	purple	37	H/D	2	
4	agaricia			18	H/D/T	1	
				20	H	1	
				100	T	2	
				27	D/J/H/T	2	
		35		32	J/T	3	
				21	H	2	
				43	H/L/T	3	
				21	D	3	
				100	J/T	3	
				32	turf	2	
		16	PURPLE	22	H/D/T	2	
				23	H/D	2	
				18	H/D/T	2	
				14	D	2	

				15	D/J	2	
				15	H/D/T	2	
				30	H/D	2	
		16	monanchora	20	H/D	1	
		21		13	d/h/j	3	
				35	h	2	
				100	J/T	2	
				78	H/D/J	2	
				29	D/L	3	
		40		60	H/J/T	3	
				39	D/J	2	
		11		36	D/H/L	2	
				38	D/J	3	
		14		26	D/J	2	
						2	
		.		45	D/J/T	2	
				34	D/H/J	2	
				100	J/T	3	
				71	D/L	3	
		32	MONANCHORA/	10	L	2	
				18	H	1	
				36	D/T	2	
				100	T	3	
				33	D/H/J	2	
11	P. BIPINATTA			35	D	2	
				22	D	2	

				23	H	1	
				38	H/J	2	
13	MONTASTREA			28	D/H/J	2	
				36	H/J	2	
				26	H/J/T	1	
				45	H/T	3	
				36	D/T	2	
				30	D/H/J/T	2	
				22	D/H/L/J	2	
				11	H/D/J	3	
				26	D/J/?	2	
					turf	2	
				100	d/t	3	
10	gorgonian			65	h/d/j/t	3	
		13	monanchora	45	d/h	3	
24	gorgonia sp					1	
				18	d/t	1	
						1	
9	porites			13	d/t	1	
				18	h/l/d	2	
						3	
6	montastrea			14	h/l	2	
				8	h	2	
5	montastrea			8	D/H	2	
8	montastrea			20	h/j/l	2	
						2	
		5	OI	7	H	2	
				15	red+H	2	

				21		2	
						2	
				50	D/L/T	2	
		15	monanchora	5	D	2	
				100	T	3	
				100	T	3	
				22	D/H/T	1	
10	montastrea			18	T	2	
				18	H/T	2	
						2	
						2	
				11	H	2	
						2	
				27	D/T	2	
14	gorgonia sp			28	D/J/T	2	
				28	D/H/T	2	
						3	
				56	D/H/J/L/T	2	
				38	L	2	
9	MONTASTREA			45	H/T	3	
				30		3	
				60	D/L/T	2	
				74	D/T	2	
		5	MONANCHORA	41	D/J/T	2	
		5	MONANCHORA	25	D/H/T	2	
		27	WHITE	27	D/J/L/T	2	
		11	WHITE	20	D/T	3	
				25	D/L/T	2	
		28	WHITE	16	L/J	3	

				20	J/T	3	
		7	MONANCHORA	17	H/J/T	2	
				13	J	3	
						1	
				43	D/J/T	2	
8	agaricia			8	D/H/J	1	
				32	D/T	2	
				50	D/H/L	2	
				60	D/J	2	
				44	H	2	
				48	D/L/T	3	
				35	D	2	
				45	D/H/T	3	
		32	MONANCHORA			2	
		11	MONANCHORA	32	H/D/T	3	
				31	H/D/J	2	
		23	WHITE	40	D/H/T	3	
		16	MONANCHORA	59	H/D/T	2	
				40	D	2	
		5	CLIONA CARRI	39	H/J	1	
				40	H/J	2	
		30	MONANCHORA	15	H/J/D	3	
7	millepora			9	J/T	1	
						2	
				29	J/T	3	

						2	
						2	
				27	D/J/T	2	
				31	H/J	2	
				24	D/J/T	2	
				17	turf	2	
				32	turf	1	
		38	MONANCHORA			2	
		25		27	D/J/T	2	
				11	D/H	1	
				29	D/T	2	
				50	D	2	
				69	h/d/j/t	2	
						2	
				20	H	2	
				18	H/D/T	2	
				100	T	2	

						1	
				54	H/D/J	2	
				78	H/D	3	
				32	H/D/T	2	
		30	MONANCHORA	17	H/D	3	
				59	D/J/T	3	
				30	D	2	
				39	D/L	2	
				37	D	2	
				28	D/H/T	1	
				44	D	2	
				31	D	1	
				58	H/T	3	
				12	J	2	
				27	H/D	2	
				22	H/D	3	
				25	h/d/j/t	2	
7	agaricia					1	
		33		21	D/L	3	
				25	D/T	1	
13	agaricia			16	L/H/D	1	
				34	D/H/J	1	
				41	h/d/j/t	3	
				33	D	2	
28	MONTASTREA			32	H/D	2	
				33	D/L/J	2	

				30	D/L/T	2	
		15		22	D/L/J	2	
				38	D/J/H/T	3	
						3	
				18	D	2	
				21	J/T	2	
				13	H/J	3	
		8	WHITE	18	D/J/T	3	
				27	J/T	2	
				16	D/H	2	
				34	D/J/H	1	
				30	D	1	
				52	D/H/J	2	
						2.05597	
				24	D	2	

% contact coral	Coral species	% contact sponge	sponge sp	% contact algae	Algae species	edge status	
				42	dictyota + turf	2	
				27	Dictyota/Halime	2	
8	millepora alcicornis			26	Dictyota/Halime	2	
				63	Dictyota/Halime	2	
						1	
						2	
						2	
				22	Dictyota/Jania/L	2	
9	porites			17	Dictyota	2	
				32	Lobophora	1	
4	sea rod			38	Dictyota	2	
				36	Dictyota	2	
		77	Orange Icing	11	Dictyota	3	
		100	Orange Icing			3	
				64	Halimeda/Dictyc	2	
				37	Halimeda/Dictyc	2	
32	gorgonian					3	
						2	
				29	Dictyota	2	
		26	cliona sp.			3	
		30	cliona sp.			3	
21	gorgonian			11	dictyota	3	
70	millepora						

80	millepora						
						2	
				29	Dictyota	1	
				36	turf	2	
				41	Lobophora/Turf	2	
				64	Lobophora/Turf	3	
				81	turf	3	
				>5	dictyota + turf	2	
				68	turf	3	
				78	turf	3	
				69	turf	3	
		5	Orange Icing	73	Lobophora/Jania	2	
				29 + 20	turf + lobophora	2	
				48	turf	2	
		7	Orange Icing	84	turf	2	
				39	turf	3	
				80	turf	2	
		20	Chondrilla nucu	48	halimeda/turf	3	
				60	turf	3	
				74	Lobophora/Jania	3	
				31	Halimeda + Jani	2	
				50	dictyota + turf	3	

				50	dictyota + jania	1	
				61	dictyota + halim	2	
				23	dictyota	1	
				22	dictyota + jania	2	
				18	dictyota + jania	2	
				23	halimeda	2	
				31	lobophora	2	
				26	dictyota + halim	2	
				42	dictyota/lobophc	3	
		21	Ulosa ruetzleri	27	dictyota	1	
				30	jania/dictyota/tu	2	
				65	turf + jania	3	
		42	Orange Icing	0		2	
				100	jania/dictyota/tu	3	
22	pseudopterogorgia bipinatta					1	
				27	Halimeda/Dictyc	2	
				27	Halimeda/Turf	1	
						3	
				26	Halimeda/Lobop	2	
		8		23	Dictyota/Jania/T	2	
				37	Dictyota	1	
				24	Dictyota	3	
				49	Lobophora	2	
				54	Halimeda/Dictyc	2	

				40	Halimeda/Dictyc	2	
				39	Halimeda/Dictyc	3	
				10	Halimeda	1	
		4	monanchora sp	43	dictyota + jania	3	
				16	Jania	3	
						3	
		28	purple sponge?			3	
				15%	Halimeda + Jani	2	
						2	
						2	
						2	
						2	
		15	Xestospongia proxima			2	
		44	Orange Icing	35	Dictyota/Halime	3	
		19	monanchora sp	11	Halimeda/Jania	2	
		40	monanchora sp	12	Jania	3	
				13	Dictyota	1	
				19	Jania	2	
				89	Halimeda + Jani	1	
		16	orange icing			2	
				26	Halimeda/Lobop	3	
		26	orange icing	40	Halimeda + Jani	3	

				69	Halimeda + Jani	3	
		17	monanchora sp	48	Halimeda + Jani	2	
				19	Halimeda/Jania/	2	
				24	Halimeda	2	
				48	dictyota + jania	2	
				79	dictyota	3	
				43	dictyota	2	
		4		62		2	
		13		n/a		2	
				100	turf + jania	3	
						n/a	
				?		3	
						3	
				24		2	
				25		1	
				30	dictyota/halimed	1	
				14	halimeda	1	
				21	halimeda	1	
						2	
				25	halimeda	3	
				-	dictyota	2	
				78	dictyota	2	
					dictyota	2	
				19	dictyota/halimed	1	
				30	dictyota/jania	2	
				40	dictyota/jania	2	
				14	dictyota	2	
				54	dictyota/jania	2	
				9	dictyota	2	
				40	dictyota/halimed	2	
23	soft					2	
23	soft					2	

				13	halimeda	2	
				24	halimeda/jania	2	
						3	
				15	dictyota	1	
47	soft					2	
				16	dictyota	2	
				28	dictyota	2	
		31		26	dictyota	2	
		43				2	
						3	
						2	
				26	jania/turf	2	
				32	jania	2	
		24				3	
				19	jania/turf	2	
						1	
				19	jania/turf	1	
24	agaricia			25	jania/turf	1	
				28	jania/turf	2	
17	siderastrea siderea					2	
						3	
		25				2	
				12	turf	2	
		24		23	halimeda	2	
15	porites asteroide	15				2	

				24	halimeda	2	
				18	halimeda/jania/	2	
				26	halimeda/jania/	2	
				17	red algae	2	
		12				2	
				15	dictyota/jania	2	
				95	dictyota	1	
				15	turf/jania	1	
				19	turf/jania	2	
				5	halimeda		
20	siderastrea sidere	57				2	
15	agaricia agaricite	15				2	
				28	dictyota/lobophc	3	
3	soft coral			27	dictyota/lobophc	2	
				79	turf/dictyota	1	
				57	halimeda/turf	1	

				29	Jania/Dictyota	1	
				30	J/H	1	
						2	
				63	Dictyota	3	
				43	Dictyota	2	
14	pseudopterogorgia bipinatta			12	Dictyota	2	
				-	Halimeda/Dictyo	1	
				100	Halimeda/Dictyo	3	
				42	Halimeda/Dictyo	2	
				30	Halimeda	2	
				28	Halimeda	2	
				77	Halimeda/Dictyo	2	
				13	Jania	2	

18	pseudopterogorgia bipinatta			16	Jania	2	
				24	Jania/Dictyota	3	
				47	Halimeda/Dictyo	1	
				38	Jania/Dictyota	2	
		31		14	Halimeda	1	
				28	Halimeda/Turf	1	
				45	Halimeda	2	
				56	Halimeda/Dictyo	2	
				40	Halimeda/Dictyo	2	
		42				1	
		26				2	
8	p.b./millepora			21	Halimeda/Dictyo	1	
				15	Halimeda	2	
				28	Halimeda/Dictyo	1	
				8	Halimeda	1	
						2	
				17	Halimeda	2	
		25		19	Halimeda/Dictyo	2	
				42	Haliemda/Dictyo	3	
				18	Halimeda	2	
				22	Halimeda	2	
		17		41	Halimeda	2	
				10	Halimeda/Dictyo	1	
				6	Halimeda	2	
				0		1	
				77	Haliemda/Dictyo	3	
		46		26	Dictyota	3	
				34	Halimeda/Jania	2	
10	millepora			11	Halimeda	2	
5	montastrea annularis			90	Dictyota/Halime	1	
				34	Dictyota	2	
				7	Dictyota	2	
				23	Dictyota	2	

						2	
				40	Halimeda	2	
				0		2	
						2	
						2	
24	Agaricia tenuifolia			21	Halimeda/Turf	2	
				16	Dictyota	2	
23	pseudopterogorgia bipinatta/porites asteroides			29	Dictyota/Halime	2	
				16	Halimeda/Dictyo	1	
		8		51		3	
						1	
				10	Halimeda	1	
				43	Halimeda/Turf	2	
12	siderastrea siderea			21	Jania/Turf	3	
				43	Dictyota/Jania	3	
		11				2	
				25	Dictyota/Turf	2	
				50	Dictyota	2	
9	agaricia agaricites					1	
				55	Dictyota/Halime	3	
				68	Dictyota	3	

				18	Dictyota/Halime	1	
				16	Dictyota/Halime	2	
				58	Dictyota/Turf	3	
		14				2	
		13		21	Dictyota/Turf	3	
		27		23	Dictyota/Halime	3	
				100	Dictyota/Halime	3	
		16				3	
				53	Dictyota/Halime	2	
		21				2	
				46	Dictyota/Halime	3	
		15		23	Dictyota/Turf	2	
		34				2	
		8				3	
				63	Dictyota	1	
		20		20	Dictyota/Halime	3	
				84	Lobophora/Jania	2	
		22		20	Dictyota	2	
		36	Orange Icing	32	Dictyota/Halime	3	
			BVS/YBS?			2	
				100	Dictyota	3	
				49	Dictyota/Jania	2	
				57	Dictyota/Lobophr	3	
				30	Dictyota	2	
				34	Dictyota	2	
				20	Dictyota	1	
				11	Lobophora/Turf	3	

				35	Dictyota	1	
				16	Dictyota	1	
		55	Orange Icing	16	Dictyota/Turf	3	
				21	Dictyota	2	
				30	Halimeda/Dictyc	2	
				58	Halimeda	2	
		14				2	