

3 **Differential occupation of available coral hosts by coral-dwelling damselfishes**
 4 **(Pomacentridae) on Australia's Great Barrier Reef**

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10 Datasets associated with his publication are available at Chase, T.; Hoogenboom, M. Occupation
 11 of damselfishes across reef seascape and colony scale, GBR 2016 data. James Cook University
 12 (dataset) 2019. <http://dx.doi.org/10.25903/5dcb4c44aa86a>.

15 **Table S1.** Relative importance of environmental variables influencing fish-coral
 16 interactions (reef seascape level), based on *MuMIn* model selection and model
 17 averaging, with AICc weighting schemes. Full beta regression models and linear
 18 mixed effects models (LME) for each fish metric included: latitude (Far North GBR,
 19 North GBR, Central GBR, and South GBR), aspect category (sheltered and
 20 exposed), habitat (sand patches, flat, crest, wall, slope/base), and coral cover (%
 21 hard scleractinian cover). Bolded numbers indicate the highest importance
 22 ranking (out of 100%) variable for each fish metric.

Fish metric	Model	Importance	Latitude	Exposure	Habitat	Coral cover
Fish presence	Beta regression	Importance	0.29	0.82	0.93	0.2
	with logit transformation	N containing models	3	5	6	4
Total Fish biomass	Linear mixed-	Importance	0.06	0.97	0.31	0.28
	effects model (LME) with log+1 transformation and maximum likelihood estimation	N containing models	1	5	3	2

Table S2. Binomial generalized linear model (GLM) output for fishes (species pooled) occupation by coral species (reef seascape level dataset). Significant *p*-values are in bold.

Factor	z-value	<i>p</i> -value
Intercept (<i>A. intermedia</i>)	-7.921	<0.001
<i>A. spathulata</i>	1.547	0.122
<i>P. damicornis</i>	3.419	0.001
<i>S. hystrix</i>	0.207	0.836
<i>S. pistillata</i>	3.137	0.002

Null deviance: 3788 on 3096 d.f.

Residual deviance: 3750 on 3092 d.f.

34 **Table S3.** Descriptive statistics of reef seascape biomass estimated (mean grams $\pm$ SE) for each damselfish species and total
 35 biomass pooled for all coral species (per occupied colony of *Acropora intermedia*, *Acropora spathulata*, *Pocillopora damicornis*,
 36 *Seriatopora hystrix*, and *Stylophora pistillata*) by site aspect (sheltered or exposed).
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Aspect	<i>n</i>	Total biomass (g) per coral species					Total avg. biomass
		<i>C. viridis</i>	<i>D. aruanus</i>	<i>D. reticulatus</i>	<i>P. amboinensis</i>	<i>P. moluccensis</i>	
<i>Sheltered</i>	627	1.09 $\pm$ 0.29	5.36 $\pm$ 0.45	0.27 $\pm$ 0.08	0.67 $\pm$ 0.06	6.96 $\pm$ 0.42	11.22 $\pm$ 0.56
<i>Exposed</i>	271	0.08 $\pm$ 0.07	0.08 $\pm$ 0.05	0.59 $\pm$ 0.33	0.63 $\pm$ 0.09	3.11 $\pm$ 0.22	7.29 $\pm$ 0.51
Overall totals/average	898	0.79 $\pm$ 0.21	3.78 $\pm$ 0.32	0.36 $\pm$ 0.12	0.66 $\pm$ 0.05	4.45 $\pm$ 0.21	

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41 **Table S4.** Descriptive statistics of reef seascape biomass estimated (mean grams $\pm$ SE) for each damselfish species (*Chromis*
42 *viridis*, *Dascyllus aruanus*, *Dascyllus reticulatus*, *Pomacentrus amboinensis*, and *Pomacentrus moluccensis*) and total biomass
43 pooled for all coral species (per occupied colony of *Acropora intermedia*, *Acropora spathulata*, *Pocillopora damicornis*, *Seriatopora*
44 *hystrix*, and *Stylophora pistillata*, but pooled in table) by habitat zone (lagoon sandy patches, flat, crest, wall, or slope/base).
45 The number of occupied colonies per habitat zone (n) is displayed and the total average biomass of all damselfish species
46 (pooled) per occupied colony per habitat zone are displayed.
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Habitat zone	n	Total biomass of damselfishes (g) per colony per habitat zone					Total avg. biomass
		<i>C. viridis</i>	<i>D. aruanus</i>	<i>D. reticulatus</i>	<i>P. amboinensis</i>	<i>P. moluccensis</i>	
Lagoon and patch	54	1.59 $\pm$ 0.54	9.12 $\pm$ 0.81	0.19 $\pm$ 0.12	0.66 $\pm$ 0.04	2.64 $\pm$ 0.22	13.87 $\pm$ 1.02
Flat	36	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	3.04 $\pm$ 0.47	3.04 $\pm$ 0.47
Crest	319	1.15 $\pm$ 0.43	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.14 $\pm$ 0.06	6.74 $\pm$ 0.57	8.03 $\pm$ 0.43
Wall	189	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.00 $\pm$ 0.00	0.03 $\pm$ 0.03	5.09 $\pm$ 0.76	5.13 $\pm$ 0.76
Slope/base	300	0.04 $\pm$ 0.02	1.43 $\pm$ 0.21	0.73 $\pm$ 0.26	0.99 $\pm$ 0.10	5.18 $\pm$ 0.33	8.34 $\pm$ 0.41
Total/average	898	0.79 $\pm$ 0.6	3.76 $\pm$ 0.10	0.36 $\pm$ 0.03	0.66 $\pm$ 0.02	4.45 $\pm$ 0.05	

Table S5. Average reef seascape biomass estimates (mean $\pm$ SE) for each damselfish species (*Chromis viridis*, *Dascyllus aruanus*, *Dascyllus reticulatus*, *Pomacentrus amboinensis*, and *Pomacentrus moluccensis*) on each coral species (*Acropora intermedia*, *Acropora spathulata*, *Pocillopora damicornis*, *Seriatopora hystrix*, and *Stylophora pistillata*) and total biomass per coral colony (fish pooled).

Coral species	n	Total biomass of damselfishes (g) per coral species					Total avg. biomass
		<i>C. viridis</i>	<i>D. aruanus</i>	<i>D. reticulatus</i>	<i>P. amboinensis</i>	<i>P. moluccensis</i>	
<i>A. intermedia</i>	54	0.70 $\pm$ 0.55	1.55 $\pm$ 0.68	0.04 $\pm$ 0.03	0.82 $\pm$ 0.22	3.12 $\pm$ 0.50	6.87 $\pm$ 1.33
<i>A. spathulata</i>	36	3.88 $\pm$ 1.71	0.50 $\pm$ 0.40	0.03 $\pm$ 0.03	0.07 $\pm$ 0.05	6.28 $\pm$ 0.97	10.88 $\pm$ 1.83
<i>P. damicornis</i>	319	0.45 $\pm$ 0.17	3.66 $\pm$ 0.59	0.05 $\pm$ 0.01	0.75 $\pm$ 0.10	4.58 $\pm$ 0.37	10.03 $\pm$ 0.73
<i>S. hystrix</i>	189	2.05 $\pm$ 0.86	6.60 $\pm$ 0.92	0.01 $\pm$ 0.01	0.67 $\pm$ 0.10	3.11 $\pm$ 0.34	12.45 $\pm$ 1.33
<i>S. pistillata</i>	300	0.01 $\pm$ 0.01	2.89 $\pm$ 0.41	0.06 $\pm$ 0.01	0.60 $\pm$ 0.09	5.17 $\pm$ 0.36	8.98 $\pm$ 0.46

Table S6. Multiple comparisons of coral-species, with p-values, (Tukey's HSD *post hoc*) based on a Gaussian generalized linear model of total damselfish biomass (damselfish species pooled), for only occupied colonies (reef seascape level dataset): total damselfish biomass (dependent) and colony species (independent variable). Significant *p*-values are in bold.

Comparison	<i>p</i> -value
<i>A. intermedia</i> – <i>A. spathulata</i>	0.5634
<i>A. intermedia</i> – <i>P. damicornis</i>	0.4105
<i>A. intermedia</i> – <i>S. hystrix</i>	0.0326
<i>A. intermedia</i> – <i>S. pistillata</i>	0.7817
<i>A. spathulata</i> – <i>P. damicornis</i>	0.9957
<i>A. spathulata</i> – <i>S. hystrix</i>	0.9578
<i>A. spathulata</i> – <i>S. pistillata</i>	0.9076
<i>P. damicornis</i> – <i>S. hystrix</i>	0.2263
<i>P. damicornis</i> – <i>S. pistillata</i>	0.8160
<i>S. hystrix</i> – <i>S. pistillata</i>	0.0243

Table S7. Multiple coral species comparisons with p-values (*post-doc* Dunn Test for (Benjamini-Hochberg method based off a Kruskal-Wallis rank sum test) for each damselfish species (damselfish-species specific biomass) for only occupied colonies (reef seascape, n = 898). Significant *p*-values are in bold.

Corral comparison	Fish Species				
	<i>C. viridis</i>	<i>D. aruanus</i>	<i>D. reticulatus</i>	<i>P. amboinensis</i>	<i>P. moluccensis</i>
<i>A. intermedia</i> – <i>A. spathulata</i>	0.0027	0.6937	1.0000	0.0258	0.0047
<i>A. intermedia</i> – <i>P. damicornis</i>	0.6187	0.2328	0.8967	0.4866	0.5573
<i>A. intermedia</i> – <i>S. hystrix</i>	0.5100	< 0.0001	1.0000	0.7315	0.5809
<i>A. intermedia</i> – <i>S. pistillata</i>	0.0988	0.4570	1.0000	0.3089	0.3801
<i>A. spathulata</i> – <i>P. damicornis</i>	< 0.0001	0.0371	1.0000	0.1634	0.1557
<i>A. spathulata</i> – <i>S. hystrix</i>	< 0.0001	< 0.0001	1.0000	0.0461	0.0004
<i>A. spathulata</i> – <i>S. pistillata</i>	< 0.0001	0.0944	1.0000	0.2828	0.2783
<i>P. damicornis</i> – <i>S. hystrix</i>	0.7141	< 0.0001	0.3689	0.7639	0.0006
<i>P. damicornis</i> – <i>S. pistillata</i>	0.1737	0.4012	1.0000	0.5676	0.5009
<i>S. hystrix</i> – <i>S. pistillata</i>	0.0537	< 0.0001	0.0279	0.4397	< 0.001

Table S8. Tukey's HSD *post-hoc* test for multiple comparisons of position of coral on benthos, with *p*-values, based on a binomial generalized linear model of damselfish presence with damselfish species pooled (colony level dataset): damselfish presence (dependent) and position on benthos (independent variable). Significant *p*-values are in bold.

Position comparison	<i>p</i> -value
Open – Crevice	0.102
Sand – Crevice	< 0.001
Underhang – Crevice	0.748
Sand – open	0.002
Underhang – Open	0.467
Underhang – Sand	< 0.001

Table S9. Tukey's HSD *post-hoc* test for multiple comparisons of position of coral on benthos, with *p*-values, based on a lognormal linear model of total biomass with damselfish species pooled for only occupied colonies (colony level dataset): total damselfish biomass (dependent) and colony position (independent variable). Significant *p*-values are in bold.

Comparison	<i>p</i> -value
Open – Crevice	0.273
Sand – Crevice	0.032
Underhang – Crevice	0.984
Sand – Open	0.980
Underhang – Open	0.182
Underhang – Sand	0.005

86 **Table S10.** Variance explained and linear models displaying differences between coral colonies with and without fish along
87 principal component analyses PC1 and PC2, for a subset of coral colonies (n = 226) at 15 different sites on 11 reefs (colony
88 level dataset). Significant p-values (PC1 and PC2 scores that are significant different between colonies with and without fish)
89 are in bold).

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Coral species	PC1 variance	PC2 variance	Cumulative variance explained (%)	PC1	PC2
All coral species (pooled)	48.05	19.75	67.8	$F_{1,224} = 35.06, p < 0.001$	$F_{1,224} = 16.48, p < 0.001$
<i>A. intermedia</i>	60.4	16.3	76.7	$F_{1,20} = 2.81, p = 0.109$	$F_{1,20} = 2.661, p = 0.119$
<i>A. spathulata</i>	51.3	18.2	69.6	$F_{1,30} = 18.44, p < 0.001$	$F_{1,30} = 0.3362, p = 0.570$
<i>P. damicornis</i>	48.3	20.1	68.4	$F_{1,64} = 48.75, p < 0.001$	$F_{1,64} = 0.1993, p = 0.661$
<i>S. hystrix</i>	39.9	26.5	66.4	$F_{1,42} = 35.72, p < 0.001$	$F_{1,42} = 2.431, p = 0.1265$
<i>S. pistillata</i>	34.2	20.9	55.13	$F_{1,60} = 85.23, p < 0.001$	$F_{1,60} = 4.342, p = 0.042$

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Table S11. SIMPER analysis results displaying the cumulative contributions of the most influential colony structure variables on coral colony occupation (presence or absence) by damselfishes (colony level dataset). SIMPER analysis was done on the standardized dataset for PCA ordination. A (-) indicates the SIMPER analysis did not identify a particular coral colony structure variable as considerably influential for predicting fish presence.

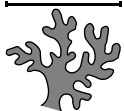
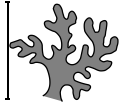
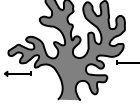
Coral species		Colony structure variable	Additional variation explained by most influential species	Cumulative contributions of most influential species
All species	coral	isolation	0.27	0.27
		branch spacing	0.20	0.47
		colony height	0.16	0.63
		branch width	0.13	0.76
		planar area	-	-
		diameter	-	-
<i>A. intermedia</i>		isolation	0.29	0.29
		planar area	0.20	0.49
		diameter	0.15	0.64
		colony height	0.15	0.79
		branch spacing	-	-
		branch width	-	-
<i>A. spathulata</i>		isolation	0.31	0.31
		planar area	0.20	0.51
		colony height	0.16	0.67
		branch spacing	0.14	0.81
		branch width	-	-
		diameter	-	-
<i>P. damicornis</i>		isolation	0.24	0.24
		branch spacing	0.22	0.46
		planar area	0.19	0.65
		colony height	0.15	0.80
		branch width	-	-
		diameter	-	-
<i>S. hystrix</i>		isolation	0.28	0.28
		branch spacing	0.24	0.52
		planar area	0.15	0.67
		colony height	0.12	0.79

	branch width	-	-
	diameter	-	-
<i>S. pistillata</i>	isolation	0.32	0.32
	planar area	0.16	0.48
	colony height	0.15	0.63
	branch spacing	0.15	0.78
	branch width	-	-
	diameter	-	-

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Table S12. Series of linear models illustrating variation in damselfishes' occupancies on small branching coral colonies (*Acropora intermedia*, *Acropora spathulata*, *Pocillopora damicornis*, *Seriatopora hystrix*, and *Stylophora pistillata*), by damselfish (*Chromis viridis*, *Dasyellus aruanus*, *Dasyellus reticulatus*, *Pomacentrus amboinensis* and *Pomacentrus moluccensis*) for six fine scale measures of colony attributes (colony level dataset). Significant p-values are in bold.

Coral species	n	Colony diameter	Planar area	Colony height	Branch spacing	Branch width	Isolation
							
		<i>Proportion of colonies occupied</i>					
<i>A. intermedia</i>	22	0.066	0.176	0.257	0.701	0.827	0.137
<i>A. spathulata</i>	32	0.314	0.135	0.041	0.002	0.685	0.009
<i>P. damicornis</i>	66	< 0.001	< 0.001	0.009	< 0.001	0.928	0.013
<i>S. hystrix</i>	44	0.304	0.433	0.189	< 0.001	< 0.001	0.019
<i>S. pistillata</i>	62	0.669	0.007	0.003	< 0.001	< 0.001	0.144
<i>All colonies</i>	224	0.021	0.026	< 0.001	<0.001	< 0.001	< 0.001

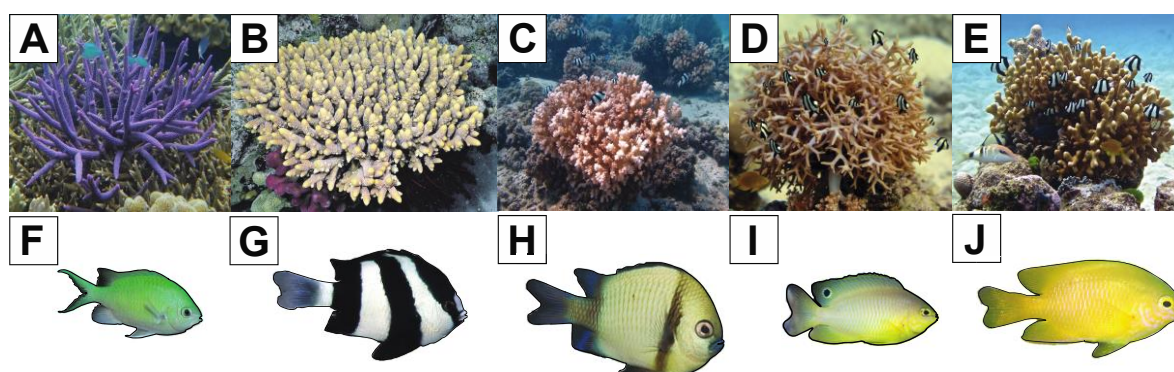
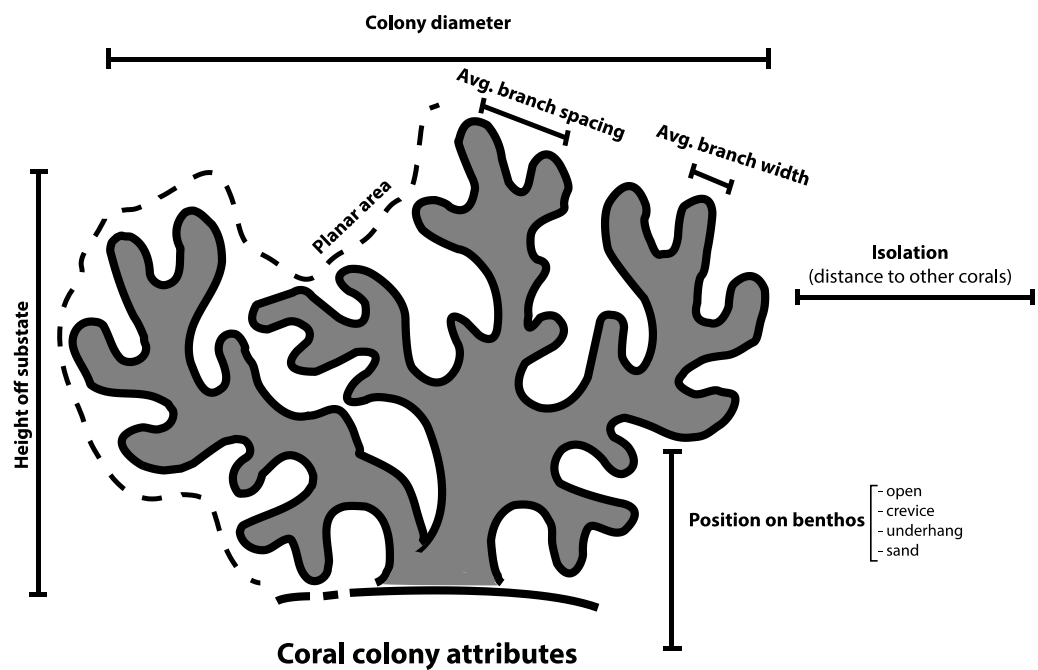


Figure S1. Focal coral-fish interactions of this study focused on (a-e) five common small branching coral species (*Acropora intermedia*, *Acropora spathulata*, *Pocillopora damicornis*, *Seriatopora hystrix*, and *Stylophora pistillata*) occupied by (f-j) five focal fish species (*Chromis viridis*, *Dascyllus aruanus*, *Dascyllus reticulatus*, *Pomacentrus amboinensis*, and *Pomacentrus moluccensis*).

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Figure S2. Illustration of 7 coral colony structure attributes for five species of branching colonies (15-100 cm diameter) for 226 colonies over 15 sites on 11 reefs. For full descriptions of coral structure attributes refer to Table 1.

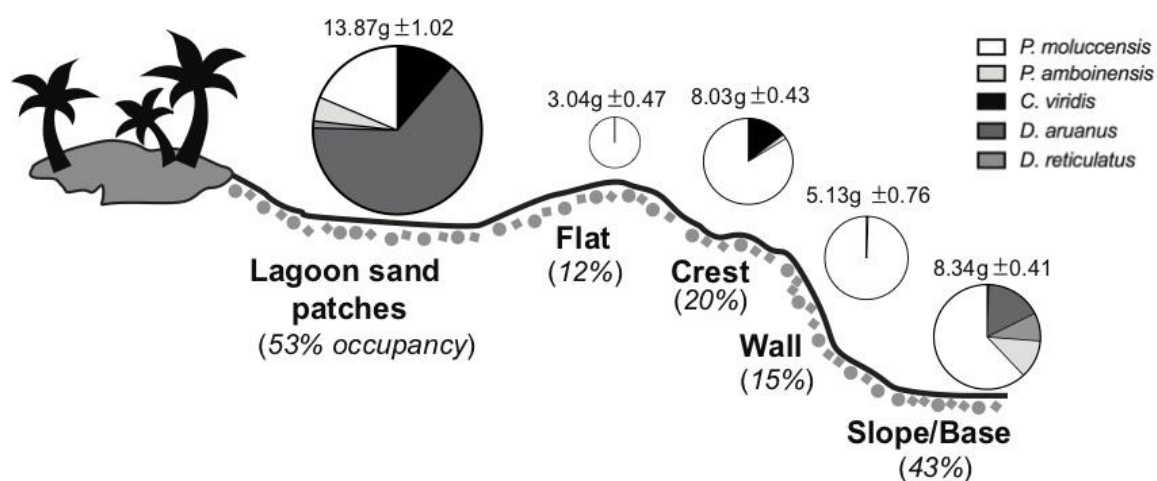


Figure S3. Average biomass (g ± SE) of damselfishes per occupied colony on the different reef habitat zones (reef seascape dataset). The areas of each circle are scaled to the overall biomass per zone. The colours of each circle indicate the proportion of biomass per each damselfish species. Overall coral occupancy per 250 m² is displayed in italics below each habitat zone.

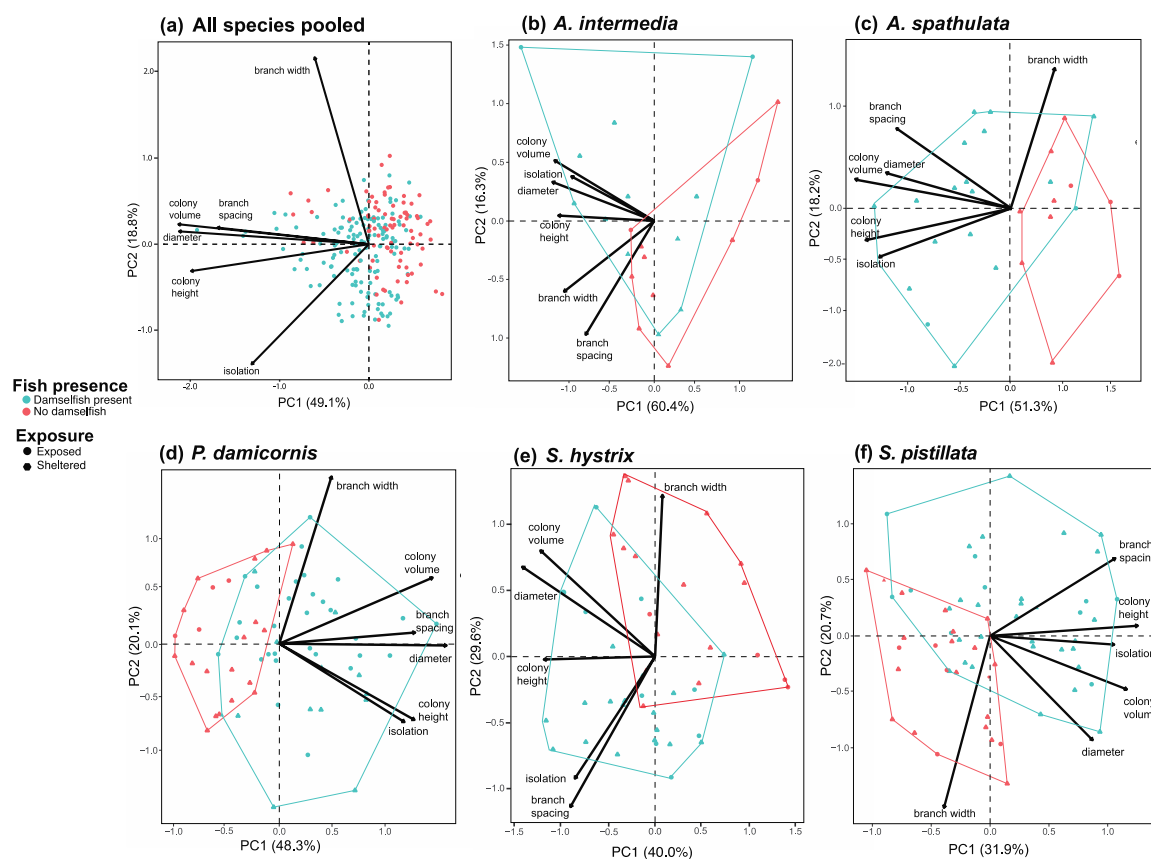


Figure S4. Principal component analysis (PCA) of coral colony structure attributes for $n = 216$ branching corals with and without resident damselfishes along mid-shelf and off-shore reefs of the GBR (colony level dataset). Primary x- and y-axis scales show standardized scores of the coral points. Convex hulls show groupings by occupancy. Eigenvectors of each coral colony structure attribute are overlaid. Principal component analysis (PCA) (a) pooled for all colonies and (b-f) for each coral species; (b) *Acropora intermedia*, (c) *Acropora spathulata*, (d) *Pocillopora damicornis*, (e) *Seriatopora hystrix*, and (f) *Stylophora pistillata*, with convex hulls according to exposure (sheltered and exposed).



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