The following supplement accompanies the article

Assemblages on limestone and siltstone boulders diverge over six years in a primary-succession transplant experiment

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Physical comparisons of limestone and siltstone boulders

To develop a comprehensive physical description of each boulder, three main physical attributes were measured. Boulder surface area, the number of crack or depression microhabitats (i.e. surface features >13 mm in size; Liversage et al. 2014), and surface rugosity indices were all measured using the methods described in Liversage et al. (2014). Additional descriptors were assessed using a small subset of representative boulders for each rock type. Hardness was measured using Moh's scale of scratch hardness, quantified by scratching boulder surfaces with a sample of the nine softest minerals on this scale. The scratch hardness of the softest mineral capable of scratching the boulder surface was assigned to each rock.

Surface-area data were square-root-transformed; data for rugosity and microhabitat density were not transformed. Analysis of rock differences for univariate variables was completed using Euclidean distances, with separate one-factor PERMANOVAs completed for upper versus lower surfaces, and for the five- and six-year transplant times. This was done to ensure data independence, as the upper and lower surfaces of the same boulders were sampled, and we could not be certain whether the same subset of boulders had been sampled after five and six years.

The transplanted limestone and siltstone boulders had different physical attributes (Table S1, Fig. S1, S2). The lighter-coloured limestone had a Moh's scratch hardness of four and was moderately friable, while the darker-coloured siltstone had a Moh's scratch hardness of eight and displayed no friability (Table S1, Fig. S1). Limestone and siltstone had different-sized upper and lower surfaces, although these differences were not significant at all sampling times (Fig. S2, Table S1). The upper surfaces of limestone were 5 % and 19 % larger than the upper surfaces of siltstone after five and six years, respectively, while the lower surfaces of siltstone were 14 % and 4 % larger than the lower surfaces of limestone for the same sampling times (Fig. S2a-b).

Surface rugosity and microhabitat density were significantly different between limestone and siltstone, for both boulder surfaces and both sampling times (Fig. S2). Limestone had complex, undulating surfaces interspersed by crack and depression microhabitats, thus lowering its rugosity index (Fig. S1, S2). In contrast, siltstone generally had flat, featureless surfaces devoid of microhabitat features, giving it a high rugosity index close to 1 (i.e. quite smooth, Fig. S1, S2).

Rock mineralogy

Mineralogy was determined by using X-ray fluorescence (XRF), with separate tests completed for major and trace element composition for three samples each of limestone and siltstone. XRF analysis tested for 11 major elements and 40 trace elements, which were returned as % composition and parts per thousand, respectively. For major elements, approximately one gram of each oven-dried sample (at 105 °C) was accurately weighed with four grams of 12-22 lithium borate flux. The mixtures were heated to 1050 °C in a platinum/gold crucible for 20 minutes to completely dissolve the sample, and then poured into a 32mm platinum/gold mould heated to a similar temperature. The melt was cooled rapidly over a compressed air stream and the resulting glass disks were analysed on a PANalytical Axios Advanced wavelength dispersive XRF system using the CSIRO in-house silicates calibration program (Jercher et al. 1998 *Archaeometry 4*0: 383-401). For trace elements, approximately four grams of each oven-dried sample (at 105 °C) was accurately weighed with one gram of Licowax binder and mixed well. The mixtures were pressed in a 32 mm die at 12 tons pressure and the resulting pellets were analysed on a PANalytical Axios Advanced wavelength dispersive XRF system using the CSIRO in-house powders program (Jercher et al. 1998).

The total major element content in limestone and siltstone was similar, while limestone contained more than double the trace element content (although this accounted for <1 % of the total sample) versus siltstone (Table S1). Both rocks also had a similar-sized 'missing' component (Table S1), which was comprised of metallic oxide weight gains via oxidation minus water and carbon dioxide loss during the XRF fusion process (M. Raven CSIRO pers. comm). As neither oxidative weight gains or water and carbon dioxide loss were measured directly, they were unable to be attributed to specific elements or compounds, and were subsequently pooled as the 'missing' component for each sample.

Mineralogy differences between rocks were identified, with transplanted limestone and siltstone having a different major element composition (Table S1). Both rocks had a mineralogy dominated by silicon dioxide (SiO□), although limestone contained a higher percentage of SiO_2 than siltstone. Siltstone had a higher content of aluminium oxide, iron oxide, and magnesium oxide (Table S1). Trace element composition also differed between limestone and siltstone (Table S1). Limestone contained high levels of chlorine, while siltstone contained small amounts of a variety of metallic elements including barium, manganese and zirconium (Table S1).

Biological observations

Twenty-eight marine species were recorded on boulders sampled after five years, while 27 marine species were recorded on boulders sampled after six years (Table S2). When pooled across both sampling times, a total of 33 marine species, spanning nine phyla, were recorded (Table S2). Of these 33 species, 21 mobile species were identified, which included anemones, flatworms, chitons, limpets, snails, isopods, and crabs. Twelve sessile taxa were recorded which included a visible biofilm, algae, tubeworms, mussels, and barnacles. The most commonly-encountered species were the barnacle *Chthamalus antennatus*, the snail *Bembicium nanum*, limpets belonging to the genus *Notoacmea*, and the tubeworm *Galeolaria caespitosa* (Table S2).

Of the two rocks transplanted as bare boulders, limestone supported a higher species pool of 30 when observations were combined across both sampling times. Twenty-five species were recorded on limestone after five years, while 26 species were recorded 12 months later (Table S2). In contrast, 25 species were recorded on siltstone, with 21 species recorded after five years and 22 species after six years (Table S2). Similar patterns of species richness were also recorded for native boulders, with native limestone supporting a higher species richness than native siltstone (Table S2). When combined across both sampling times, a species richness of 26 was recorded for native limestone, with 21 species recorded after five years and 15 species recorded after six years. In contrast, a combined species richness of only 16 was recorded for native siltstone, with 14 species recorded after five years, and just 7 species recorded after six years (Table S2). Lower boulder surfaces appeared to support a greater mean richness of marine species when compared to upper surfaces (Fig. S5).

Table S1. Physical attributes of transplanted limestone versus siltstone. Colour is expressed as descriptive colour Hue Value/Chroma on Munsell colour charts where YR = yellow-red.

Physical attribute	**Rock:**	**Limestone**	**Siltstone**
Scratch hardness (Mohs' scale)		4	8
Friability		Moderate	None
Colour (Munsell colour chart)		Light grey 10 YR 8/1	Greyish yellow-brown 10 YR 5/2
Composition (%, mean ± SE)	Major elements	87.9 ± 1.4	87.9 ± 3.8
	Trace elements	0.5 ± 0.1	0.2 ± 0
	'Missing'	11.5 ± 1.4	11.9 ± 3.8
Mineralogy: Major elements (%, mean ± SE)	SiO_2	71.6 ± 3.1	55.4 ± 6.6
	Al_2O_3	1.2 ± 0.3	8.8 ± 0.6
	Fe_2O_3	0.9 ± 0.1	4.1 ± 0.6
	MgO	0.6 ± 0.1	3.3 ± 0.1
	K_2O	0.5 ± 0.1	2.1 ± 0.1
	TiO_2	0.1 ± 0.0	0.6 ± 0.1
	CaO	12.3 ± 1.8	12.0 ± 4.2
	Na_2O	0.6 ± 0.1	1.3 ± 0.4
	MnO_2	0 ± 0	0.1 ± 0.0
	P_2O_5	0.1 ± 0	0.1 ± 0
	SO_3	0.2 ± 0.0	0.0 ± 0.0
Mineralogy: Dominant trace elements (ppm, mean ± SE)		Cl 4884 ± 882 Sr 157 ± 16 Zr 76 ± 11 Co 46 ± 22	Mn 622 ± 77 Ba 288 ± 32 Zr 198 ± 13 Cl 192 ± 105

Table S2. Species list for algae and invertebrates recorded on boulder surfaces for each sampling time at each seashore. TL = transplanted limestone; TS = transplanted siltstone; NS = native siltstone; and NL = native limestone.

			Seashore:	Marino Rocks						Myponga Beach						Blanche Point						Southport					
			Sampling time (years):	5			6			5			6			5			6			5			6		
Phyla	Class	Family	Species Boulder	TL	TS	NS	TL	TS	NS	TL	TS	NS	TL	TS	NS	TL	TS	NL	TL	TS	NL	TL	TS	NL	TL	TS	NL
Algae			Biofilm				x						x						x	x	x				x		x
Chlorophyta	Ulvophyceae	Ulvaceae	*Enteromorpha* sp.																x		x	x			x		x
Heterokontophyta	Phaeophyceae		Unknown filamentous																	x	x						
Rhodophyta	Florideophyceae	Corallinaceae	*Corallina officinalis*																					x			
			Crustose 'pink paint'										x												x		x
		Gelidiaceae	*Capreolia implexa*							x			x						x			x		x			
Animals																											
Cnidaria	Anthozoa	Actiniidae	*Actinia tenebrosa*											x		x	x	x	x	x		x	x	x		x	
			Isanemonia australis			x																x	x	x	x		
Platyhelminthes	Rhabditophora	Notoplanidae	*Notoplana australis*		x	x		x										x									
Annelida	Polychaeta	Oenonidae	*Notopsilus* sp.								x					x											
		Serpulidae	*Galeolaria caespitosa*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
			Spirorbid sp.		x					x	x		x		x	x		x				x	x	x	x	x	x
Mollusca	Polyplacophora	Ischnochitoniidae	*Ischnochiton elongatus*		x	x										x	x	x	x	x		x		x	x	x	
	Gastropoda	Fisurellidae	*Montfortula rugosa*									x										x		x	x		
		Lottidae	*Notoacmaea* spp.	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Littorinidae	*Bembicium nanum*	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
			Bembicium vittatum	x	x											x									x		
		Nacellidae	*Cellana tramoserica*			x	x				x	x										x	x	x	x		
		Neritopsidae	*Nerita atramentosa*	x	x	x	x	x	x	x	x	x	x	x	x		x										
		Siphonariidae	*Siphonaria diemenensis*	x	x		x			x		x	x			x	x	x	x	x	x	x	x	x	x	x	x
			Siphonaria zelandica															x				x		x			
		Trochidae	*Austrocochlea constricta*														x	x				x	x	x	x		
			Austrocochlea porcata														x	x									
			Diloma concamerata	x	x	x	x	x	x	x	x	x	x	x	x				x								
		Muricidae	*Haustrum vinosum*							x																	
	Bivalvia	Mytilidae	*Brachidontes rostratus*																			x	x	x			
			Xenostrobus pulex	x	x	x							x			x	x	x	x		x	x	x	x	x	x	x
Arthropoda	Malacostraca	Eriphiidae	*Ozius truncatus*	x	x			x		x		x		x		x	x	x	x	x	x	x	x	x		x	x
		Grapsidae	*Cyclograpsus granulosus*																						x		
		Idoteidae	*Euidotea bakeri*				x																		x		
		Sphaeromatidae	*Zuzara venosa*																			x		x	x		
	Maxillopoda	Chthamalidae	*Chthamalus antennatus*	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Tetraclitidae	*Tetraclitella purpurascens*				x			x			x	x		x	x		x		x		x				x
Total species richness per boulder (summed)				**10**	**12**	**11**	**11**	**7**	**6**	**12**	**9**	**10**	**13**	**9**	**7**	**13**	**13**	**14**	**14**	**10**	**11**	**19**	**14**	**19**	**18**	**10**	**12**

Table S3. *P* values from PERMANOVA planned comparisons testing for assemblage differences between transplanted limestone and siltstone. Analyses were completed separately for each seashore, sampling time, and surface. Significant results (α = 0.05) are shown in bold, with MC = *p*-value used from Monte Carlo tests. The total degrees of freedom for each comparison ranged from 15 for surfaces sampled at SP after 6 years to 29 for surfaces sampled at MB, MR and SP after 5 years. MB = Myponga Beach, MR = Marino Rocks, SP = Southport; and BP = Blanche Point.

Surface		**Upper**				**Lower**			
	Seashore	**MB**	**MR**	**SP**	**BP**	**MB**	**MR**	**SP**	**BP**
Measure	**Year**								
Mobile invertebrate assemblage structure	5	**0.0384**	**0.0002**	0.2773	0.1811	0.856	0.2207	0.0945	0.1207
	6	**0.0068**	**0.0022**	0.887 (MC)	0.2582	0.2659	**0.028**	0.2376	0.6759
Sessile assemblage structure	5	**0.0006**	**0.0009**	0.1097	0.0913 (MC)	**0.0019**	**0.0001**	0.3075	0.0882
	6	0.3965 (MC)	**0.0332 (MC)**	0.0559	**0.0005**	**0.0197**	**0.0013 (MC)**	0.4319	**0.0037**
Species richness	5	**0.0006 (MC)**	**0.0077**	0.1728	**0.0246 (MC)**	0.1154	**0.0181**	0.2383	0.1900
	6	0.4331 (MC)	**0.0004 (MC)**	0.6593	**0.0154 (MC)**	0.4650	**0.0043**	0.1555 (MC)	**0.0023**
Barnacle abundance	5	**0.0031 (MC)**	0.2295 (MC)	**0.0007**	**0.0282 (MC)**	0.0839	0.0698 (MC)	**0.0025**	0.3346 (MC)
	6	0.4049 (MC)	0.0561 (MC)	0.2198 (MC)	0.4687	0.0719 (MC)	0.2317 (MC)	0.1399 (MC)	0.3379 (MC)

Table S4. SIMPER analyses identifying consistent (SD/Sim ratio >1) indicator species associated with assemblage differences on transplanted limestone (TL) versus transplanted siltstone (TS). Abundances are expressed as the mean number of individuals per boulder surface. Some combinations of seashore/boulder surface/ sampling time are missing, when PERMANOVAs detected no significant differences between rocks.

Measure	Year	Boulder surface	Seashore	Average dissimilarity (%)	Indicator species	TL abundance		TS abundance	Rock preference
Mobile assemblage structure	5	Upper	Myponga Beach	98.1	*Bembicium nanum*	1.09	>	0.00	Limestone
					Notoacmea spp.	0.27	<	0.70	Siltstone
			Marino Rocks	97.4	*Bembicium nanum*	1.45	>	0.00	Limestone
					Notoacmea spp.	0.10	<	0.81	Siltstone
	6	Upper	Myponga Beach	92.0	*Notoacmea* spp.	0.14	<	2.56	Siltstone
					Bembicium nanum	1.16	>	0.14	Limestone
			Marino Rocks	89.3	*Bembicium nanum*	1.50	>	0.14	Limestone
					Notoacmea spp.	0.40	>	0.14	Limestone
		Lower	Marino Rocks	65.7	*Nerita atramentosa*	1.81	>	0.61	Limestone
					Notoacmea spp.	1.56	>	1.49	Limestone
					Bembicium nanum	0.84	>	0.14	Limestone
Sessile assemblage structure	5	Upper	Myponga Beach	85.3	*Galeolaria caespitosa*	1.63	>	0.22	Limestone
			Marino Rocks	81.1	*Galeolaria caespitosa*	1.91	>	0.41	Limestone
		Lower	Myponga Beach	73.4	*Galeolaria caespitosa*	3.82	>	0.79	Limestone
			Marino Rocks	89.7	*Galeolaria caespitosa*	2.92	>	0.21	Limestone
	6	Upper	Marino Rocks	100.0	*Galeolaria caespitosa*	0.73	>	0.00	Limestone
			Blanche Point	88.1	Biofilm	1.87	>	0.59	Limestone
					Galeolaria caespitosa	1.57	>	0.10	Limestone
		Lower	Myponga Beach	57.6	*Galeolaria caespitosa*	2.30	>	0.75	Limestone
			Marino Rocks	90.4	*Galeolaria caespitosa*	2.23	>	0.25	Limestone
			Blanche Point	80.7	Biofilm	2.11	>	0.28	Limestone
					Galeolaria caespitosa	2.88	>	0.67	Limestone

Table S5. *P* values for PERMANOVA planned comparisons testing for assemblage differences between native and transplanted boulders of the same rock. Analyses were completed separately for each seashore, sampling time, and surface. Significant results (α = 0.05) are shown in bold, with MC = *p*-value used from Monte Carlo tests. The total degrees of freedom for each comparison ranged from 15 for surfaces sampled at SP after 6 years to 29 for surfaces sampled at MB, MR and SP after 5 years. MB = Myponga Beach, MR = Marino Rocks, SP = Southport; and BP = Blanche Point.

Measure	Surface Seashore Year	Upper MB	 MR	 SP	 BP	Lower MB	 MR	 SP	 BP
Mobile invertebrate assemblage structure	5	0.1413 (MC)	0.1293 (MC)	0.4667	0.1126	0.5631	0.5152	0.2546	0.8126
	6	**0.0284 (MC)**	0.72656 (MC)	0.5086 (MC)	0.8483	0.0602	0.7089	**0.0373**	0.4018
Sessile assemblage structure	5	0.1222	0.0903	0.4993	0.3497	0.1959	0.1071	0.6472	0.8609
	6	0.3207 (MC)	0.1455 (MC)	0.9327	0.3584	0.0660	0.7013 (MC)	0.9422	0.2093
Barnacle abundance	5	0.1635 (MC)	0.3232	0.1673	0.0971 (MC)	0.3201 (MC)	0.3315 (MC)	**0.0428 (MC)**	0.4784 (MC)
	6	0.0603 (MC)	0.1223 (MC)	**0.0138 (MC)**	0.4671	0.3275 (MC)	0.8733 (MC)	0.2398 (MC)	0.2386 (MC)
Total species richness	5	0.0600 (MC)	0.0538 (MC)	0.7865	0.1491 (MC)	0.7524	0.8169	0.2742	0.4161
	6	0.1414 (MC)	0.6452 (MC)	0.9613 (MC)	0.4999 (MC)	0.3088 (MC)	0.4733 (MC)	**0.0194 (MC)**	**0.0202 (MC)**

Table S6. *P* values for PERMANOVAs testing for assemblage differences among sampling times (11 months, 5 years and 6 years) for transplanted limestone versus siltstone across all seashores. Analyses were completed separately for upper versus lower surfaces. Significant results (α = 0.05) are shown in bold. The interaction term Seashore x Rock x Sampling time was excluded from analyses.

	Measure	**Mobile assemblage structure**		**Sessile assemblage structure**		**Species richness**		**Barnacle abundance**	
Source	**df**	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**	**Lower**	**Upper**	**Lower**
Seashore	3	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
Rock	1	**0.0001**	**0.0004**	**0.0288**	0.0877	**0.0289**	0.1130	0.0576	0.063
Sampling time	2	**0.0001**	**0.0004**	0.1034	**0.0026**	0.7999	0.0725	0.5317	0.1047
Seashore x Rock	3	0.0915	0.6488	0.1737	**0.0001**	0.5596	**0.0118**	**0.0048**	**0.0001**
Seashore x Sampling time	6	**0.0006**	**0.0001**	**0.0001**	0.0556	0.1106	**0.0373**	0.7831	0.1612
Rock x Sampling time	2	0.2964	0.2971	**0.0116***	**0.0031**	0.5819	**0.0031***	0.6387	0.3951
Residual	177								

* We detected significant interactions between sampling time and rock for sessile assemblage structure on upper surfaces and species richness on lower surfaces, but the changes over time for either rock were too subtle to be determined via post hoc tests (all PERMANOVA pair-wise permuted *p*-values >0.05).

Table S7. *P*-values from PERMANOVA tests for assemblage differences for the composite factor boulder history (transplanted limestone, transplanted siltstone, native limestone, and native siltstone). Analyses were completed separately for each seashore, sampling time, and boulder surface. Significant results (α = 0.05) are shown in bold. The total degrees of freedom for each comparison ranged from 15 for surfaces sampled at SP after 6 years to 29 for surfaces sampled at MB, MR and SP after 5 years. MB = Myponga Beach, MR = Marino Rocks, SP = Southport and BP = Blanche Point.

	Surface	**Upper**				**Lower**			
	Shore	**MB**	**MR**	**SP**	**BP**	**MB**	**MR**	**SP**	**BP**
Measure	**Years**								
Mobile invertebrate	5	0.0799	**0.0001**	2311	0.0817	0.9235	0.275	**0.0485**	0.0525
assemblage structure	6	**0.0007**	**0.0004**	0.8812	0.4916	0.2263	0.1089	0.0686	0.7274
Sessile assemblage	5	**0.0021**	**0.0001**	0.07	**0.0195**	**0.0044**	**0.0001**	0.80	0.28
structure	6	0.26	**0.0193**	0.08	**0.0124**	0.05	**0.0008**	0.71	**0.0063**
Species richness	5	**0.0017**	**0.0004**	0.12	0.06	0.19	**0.0405**	0.12	0.32
	6	0.07	**0.0033**	0.86	**0.0331**	0.22	**0.0016**	0.05	**0.0028**
Barnacle abundance	5	**0.0099**	0.0822 (MC)	**0.0014**	**0.0355**	**0.0361**	0.1627	**0.0001**	0.2264
	6	0.1292 (MC)	0.1772 (MC)	**0.0146**	0.5687	0.0715 (MC)	0.2437 (MC)	**0.0079**	0.2124 (MC)

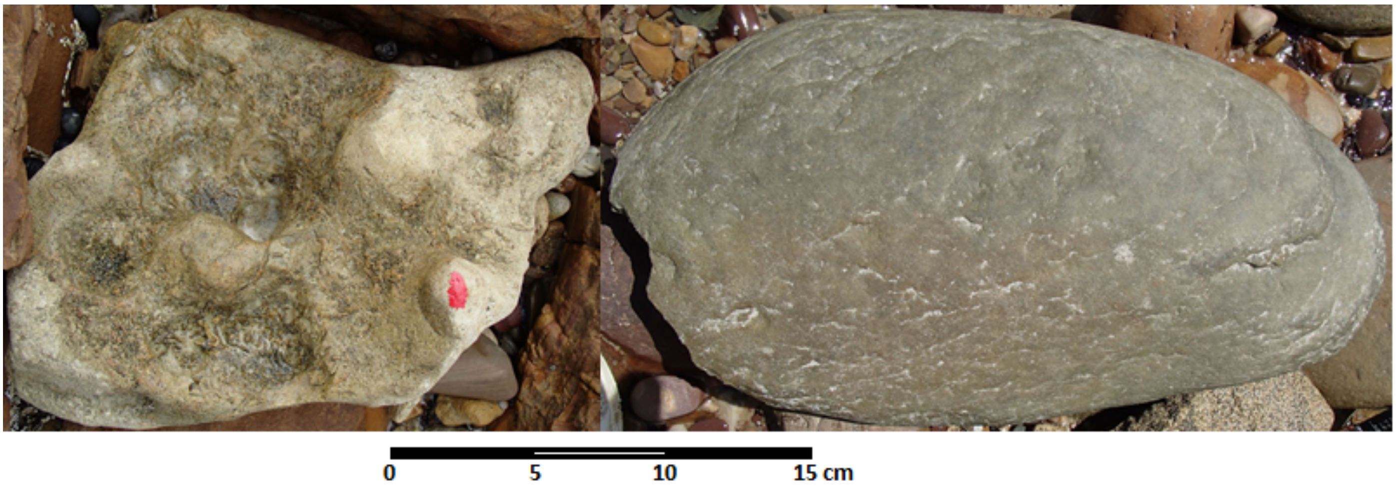

Fig. S1. Upper surfaces of a transplanted limestone (left image) and transplanted siltstone (right image) boulder sampled at Marino Rocks after six years.

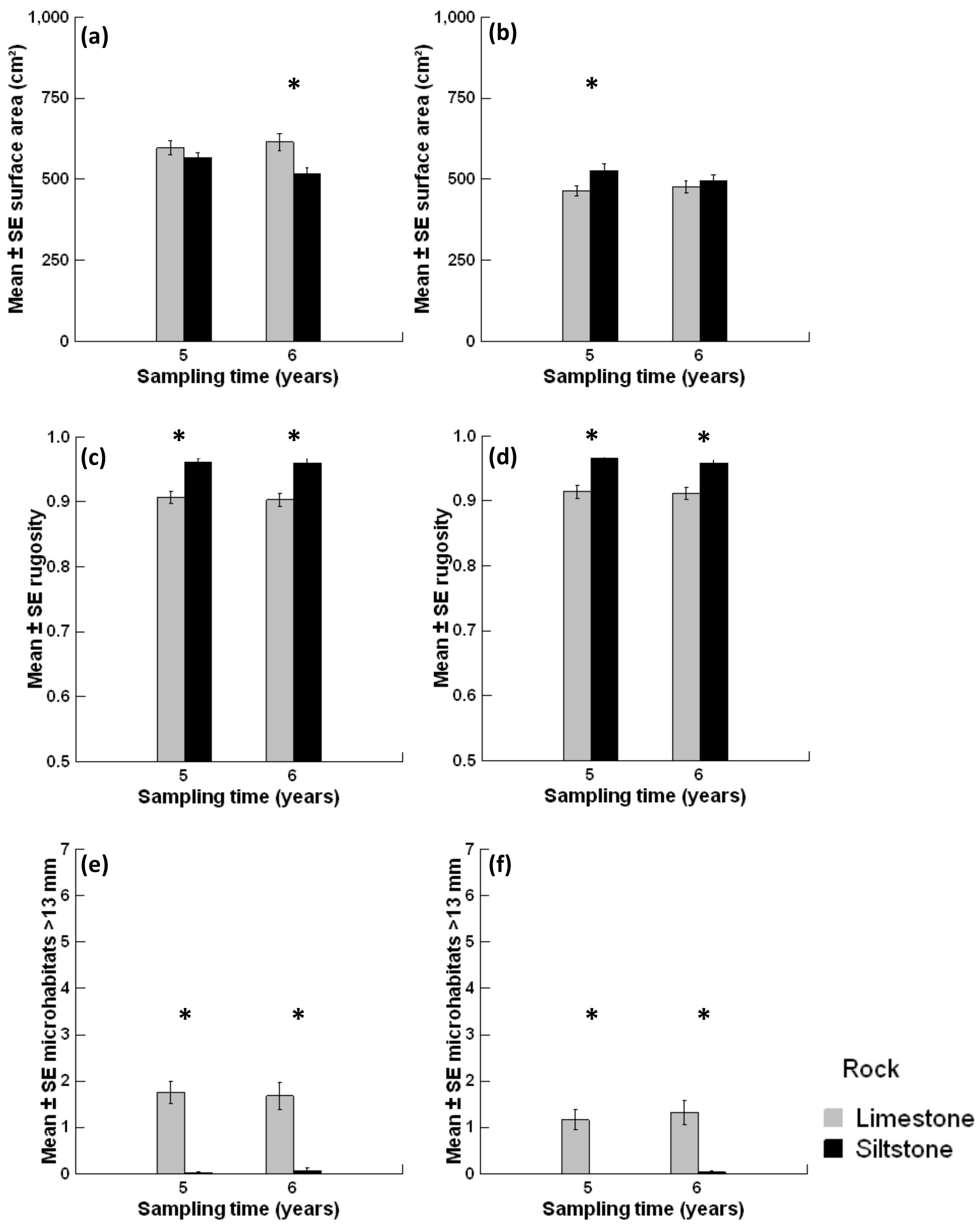

Fig. S2. Mean ± SE surface area (a-b), rugosity (c-d), and microhabitat >13 mm density (e-f) for the upper (a, c, e) and lower (b, d, f) surfaces of transplanted limestone versus siltstone for each sampling time. Averages calculated from totals of 37 limestone and 40 siltstone boulders sampled after 5 years, and 25 limestone and 27 siltstone boulders sampled after 6 years. Each y-axis extends to encompass the range of the raw data. * = significant ($p < 0.05$) difference detected between rocks

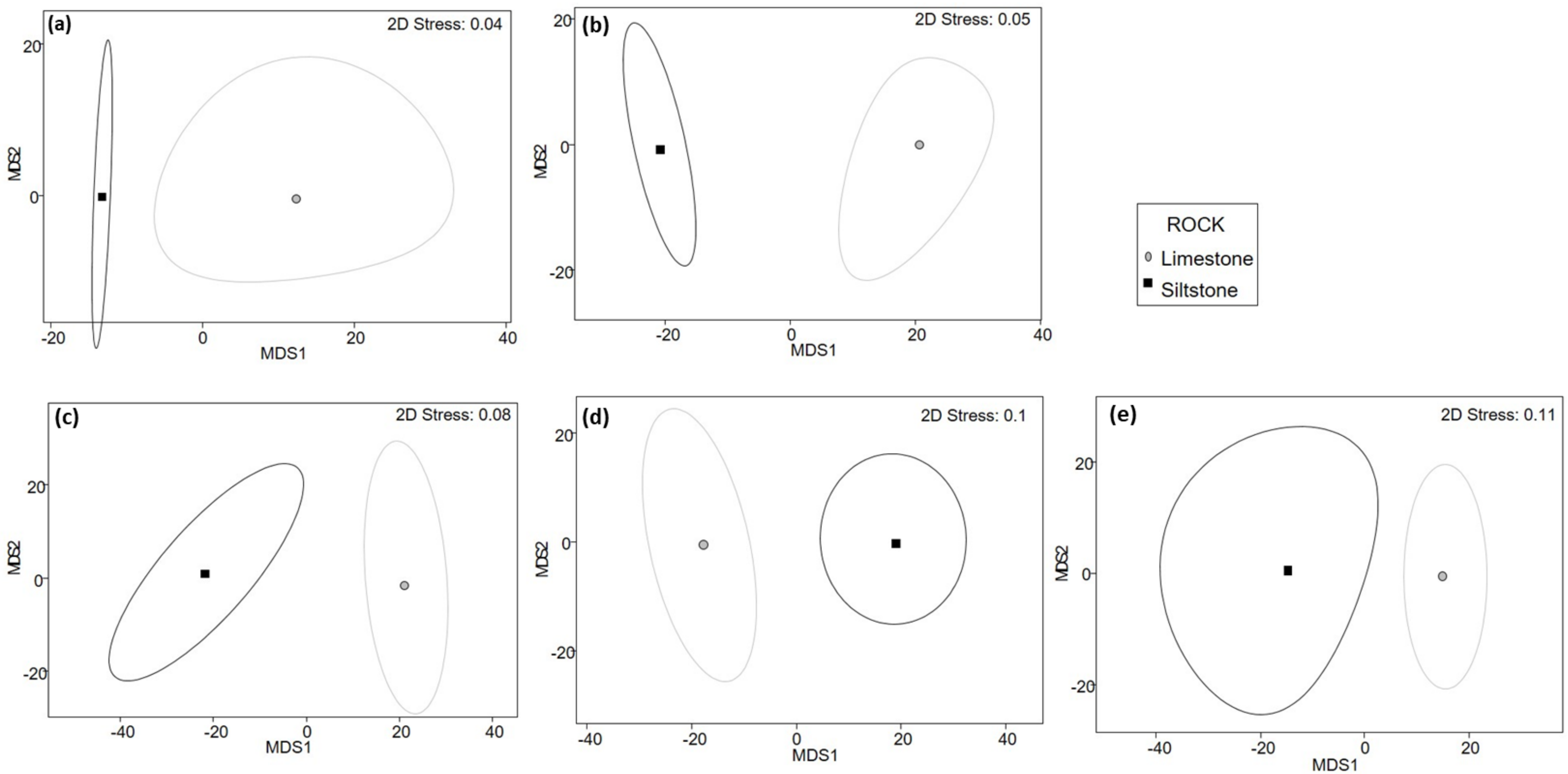

Fig. S3. Bootstrapped averages ordination plots depicting significantly-divergent mobile invertebrate assemblages detected during PERMANOVA planned comparisons between transplanted limestone versus siltstone: (a) upper surfaces at Myponga Beach after 5 years; (b) upper surfaces at Marino Rocks after 5 years; (c) upper surfaces at Myponga Beach after 6 years; (d) upper surfaces at Marino Rocks after 6 years; (e) lower surfaces at Marino Rocks after 6 years.

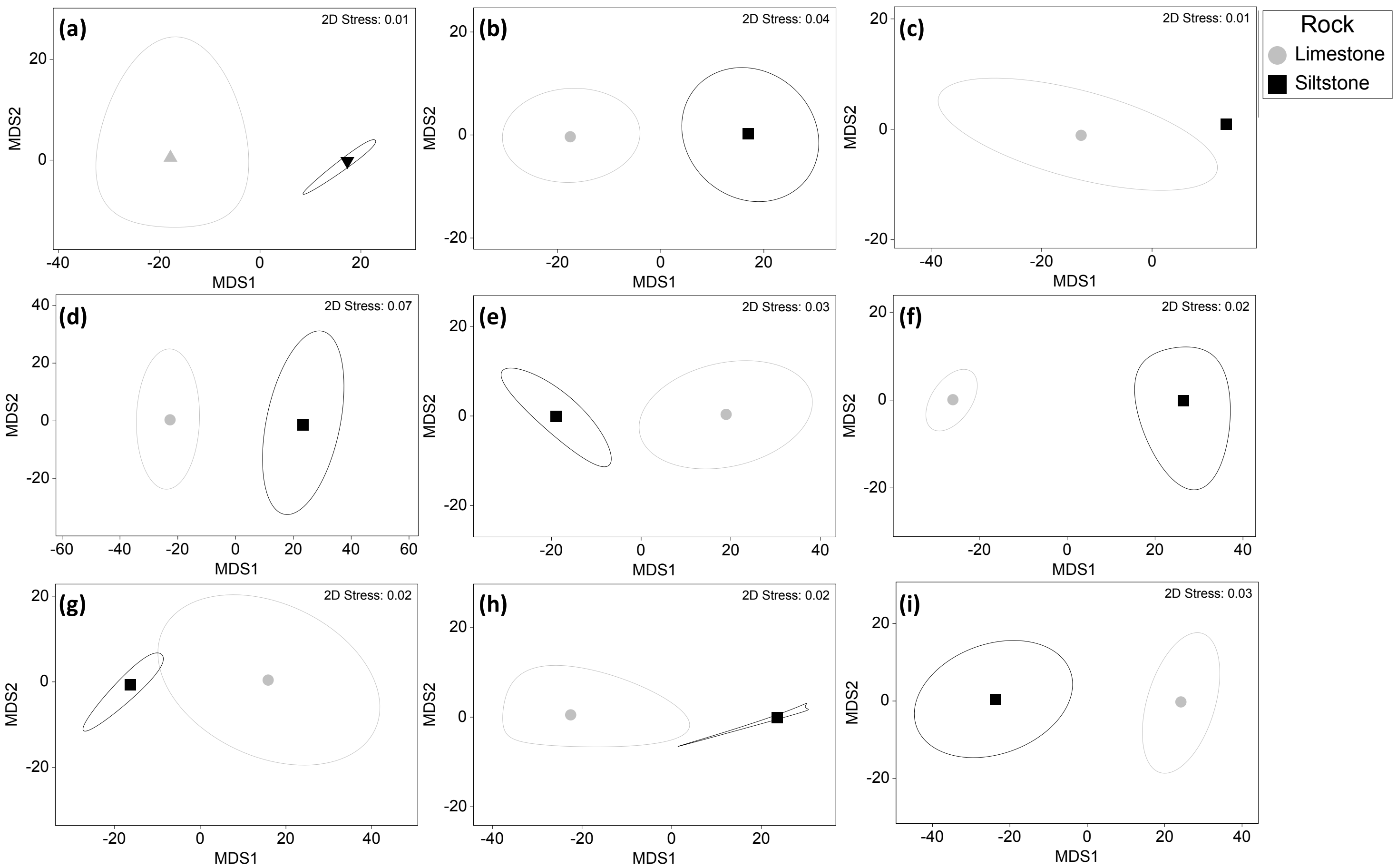

Fig. S4. Bootstrapped averages ordination plots depicting significantly-divergent sessile assemblages detected during PERMANOVA planned comparisons between transplanted limestone versus siltstone: (a) upper surfaces at Myponga Beach after 5 years; (b) upper surfaces at Marino Rocks after 5 years; (c) upper surfaces at Marino Rocks after 6 years; (d) upper surfaces at Blanche Point after 6 years; (e) lower surfaces at Myponga Beach after 5 years; (f) lower surfaces at Marino Rocks after 5 years; (g) lower surfaces at Myponga Beach after 6 years; (h) lower surfaces at Marino Rocks after 6 years; and (i) lower surfaces at Blanche Point after 6 years.

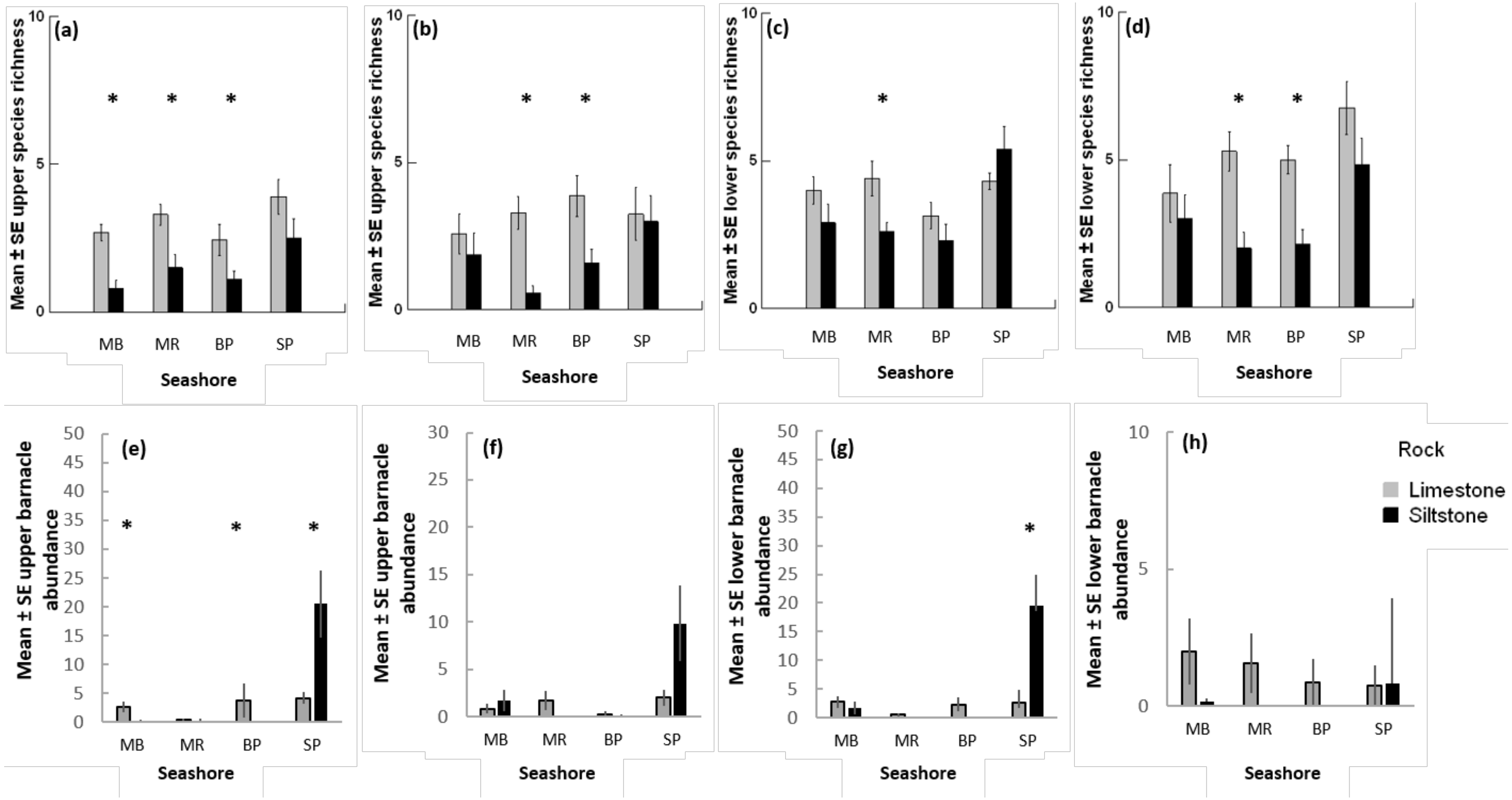

Fig. S5. Mean ± SE species richness (a-d) and barnacle abundance (e-h) for upper (a,b,e,f) versus lower (c,d,g,h) transplanted boulders for each sampling time: a) 5 years upper species richness; b) 6 years upper species richness; c) 5 years lower species richness; d) 6 years lower species richness; e) 5 years upper barnacle abundance; f) 6 years upper barnacle abundance; g) 5 years lower barnacle abundance; and h) 6 years lower barnacle abundance. Each y-axis extends to encompass the full range of the raw data. MB = Myponga Beach; MR = Marino Rocks; BP = Blanche Point; and SP = Southport. * = significant ($p < 0.05$) difference detected between rocks.

Comparison of boulder assemblages between limestone versus siltstone reefs and representative seashores of these reefs

Several boulder transplant experiments have shown that associations between assemblages and rocks can be scale dependent, with patterns observed at the scale of reefs not applicable at the scale of individual boulders transplanted on those reefs (see McGuinness 1988; Green et al. 2012; Liversage et al. 2014). To assess associations between boulder assemblages and different rocks at the reef-scale, and at representative seashores of those reefs, two-factor PERMANOVA models were used to test ($\alpha = 0.05$) for differences among reef types (limestone versus siltstone; a fixed factor), and seashores nested in reef types (Marino Rocks, Myponga Beach, Southport, or Blanche Point; a random factor). For all PERMANOVA tests, permutations of residuals were completed using a reduced model with 9999 permutations, with a Monte Carlo (MC) *p*-value replacing a PERMANOVA *p*-value when the number of available unique permutations was <100 (Anderson et al. 2008). Only transplanted boulders were included in analyses, with PERMANOVAs completed separately for the multivariate measures of mobile or sessile assemblage structure, and for the univariate measures of species richness and barnacle abundance. Separate PERMANOVAs were also completed for upper versus lower surfaces, and for both sampling times. MDS bootstrapped-averages ordination plots were used to visualise significant multivariate differences between seashores.

Assemblage structure was generally similar between siltstone versus limestone reefs, with lower-surface mobile assemblage structure the only significant reef difference (Table S8). Limestone reefs usually supported a higher species richness and barnacle abundance than siltstone reefs, for both boulder surfaces and both sampling times, although these differences were never significant (Table S8).

The structure and species richness of assemblages was often different among representative seashores of limestone versus siltstone reefs. Mobile invertebrate assemblage structure was significantly different among seashores for all surface and time combinations except upper surfaces after 5 years, while sessile assemblage structure was significantly different among seashores for upper surfaces only (Fig. S6, Table S8). Generally, the assemblages sampled at limestone seashores were very distinct from each other, while the assemblages sampled at siltstone seashores clustered more closely, and at times overlapped with the assemblages sampled on limestone at Blanche Point (Fig. S6). Significant differences among seashores within reefs were also detected for the univariate measures of species richness after five years and barnacle abundance in both years (Table S8). Generally, boulders sampled at Southport supported assemblages with the highest species richness and barnacle abundance (Fig. S7). We postulate that the very distinct assemblages recorded at Southport may be attributed to that locations low relief, such that boulders might not be exposed to stressful conditions for as long during hot daytime summer low tides compared to the other seashores sampled. Thus the boulders at Southport may be able to support more species in greater abundances.

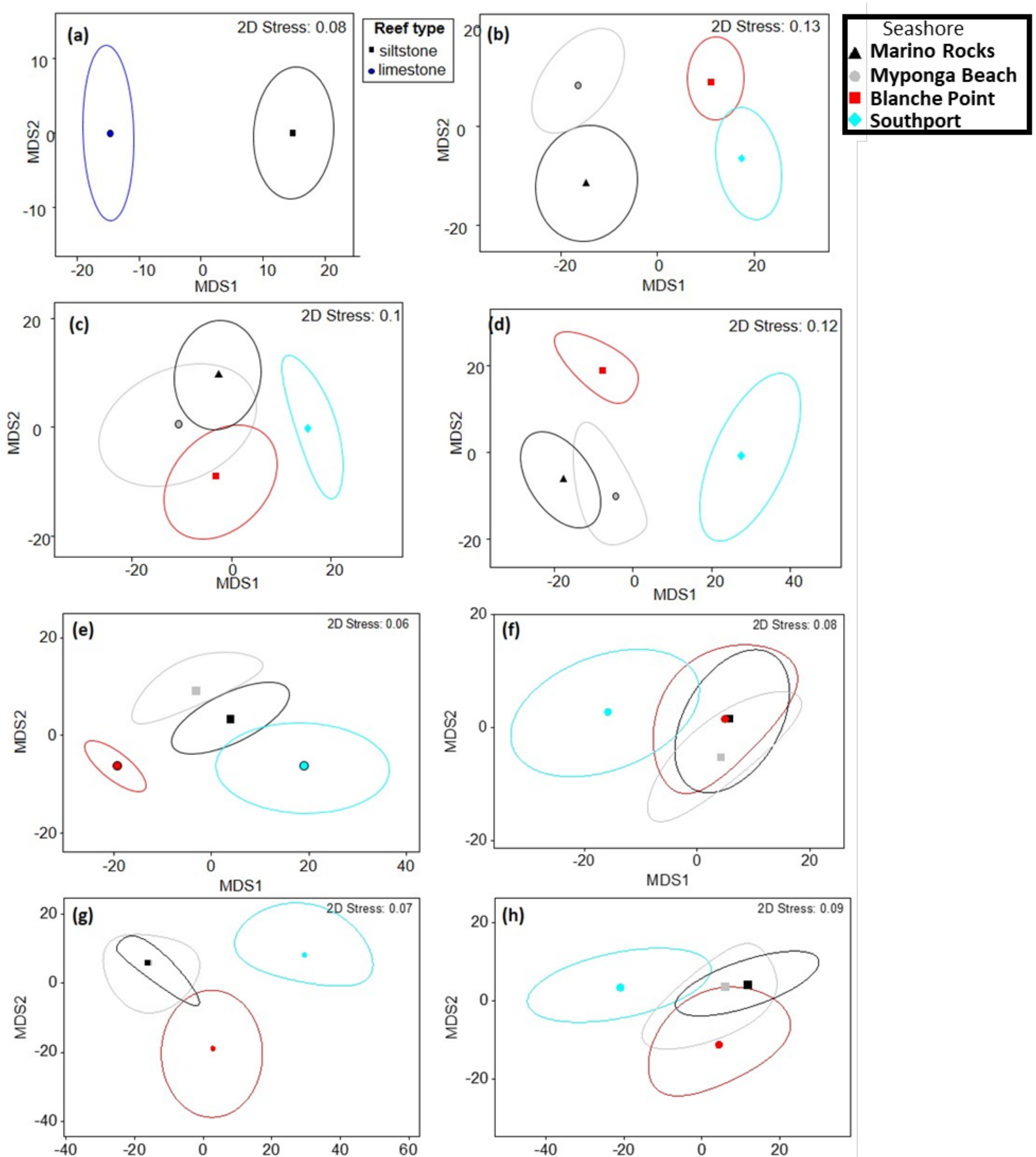
(a)
2D Stress: 0.08
Reef type
siltstone
limestone
MDS2
MDS1
(b)
2D Stress: 0.13
Seashore
Marino Rocks
Myponga Beach
Blanche Point
Southport
(c)
2D Stress: 0.1
(d)
2D Stress: 0.12
(e)
2D Stress: 0.06
(f)
2D Stress: 0.08
(g)
2D Stress: 0.07
(h)
2D Stress: 0.09

Fig. S6. Bootstrapped-averages ordination plots depicting significant differences in mobile assemblages (a-d) and sessile assemblages (e-h) between (a) reef types for lower surfaces after 5 years; and sites for (b) lower surfaces after 5 years; (c) upper surfaces after 6 years; (d) lower surfaces after 6 years; (e) upper surfaces after 5 years; (f) lower surfaces after 5 years; (g) upper surfaces after 6 years; and (h) lower surfaces after 6 years.

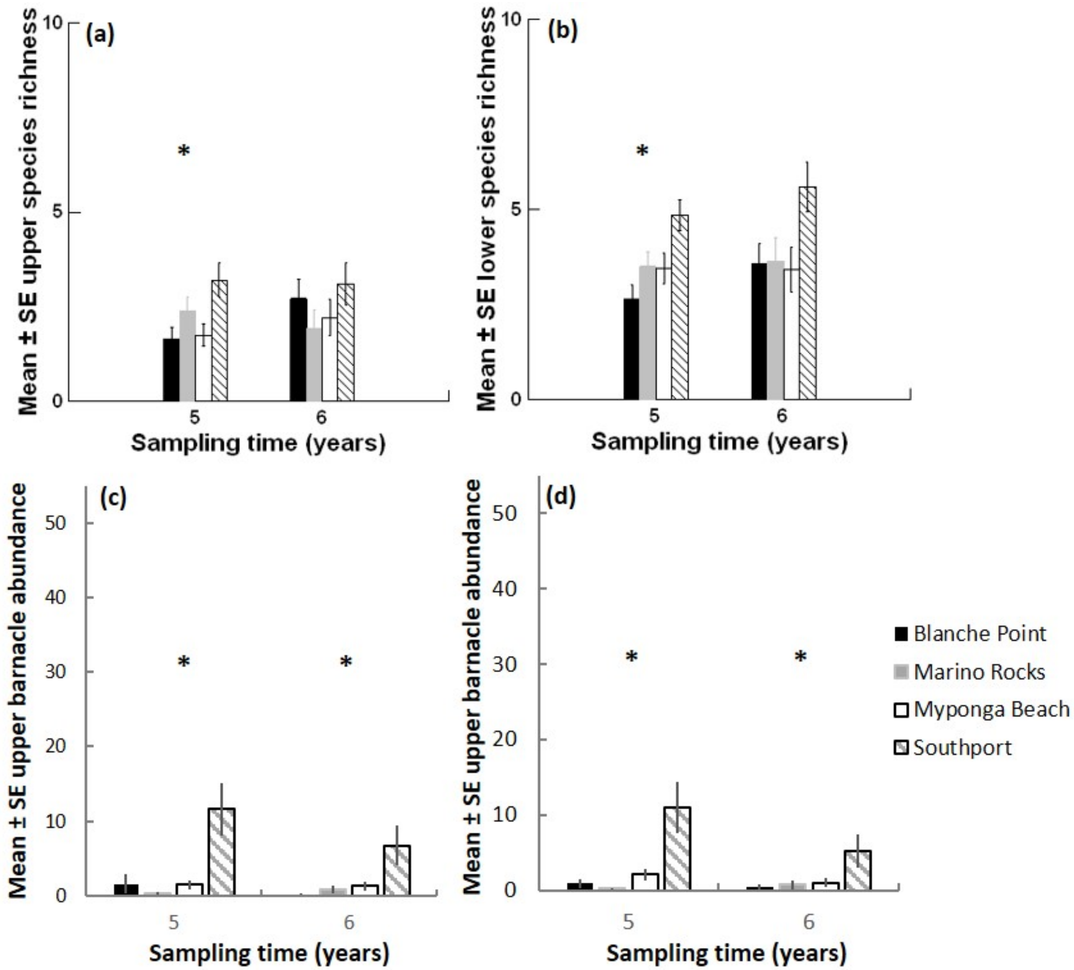

Fig. S7. Mean ± standard error (SE) species richness (a-b) and barnacle abundance (c-d) for transplanted boulders sampled at each seashore for upper (a, c) and lower (b, d) surfaces, and both sampling times. The range displayed on each y-axis extends to encompass the range of the raw data. * = significant difference detected amongst seashores.

Table S8. PERMANOVA tests for assemblage differences among the factors of reef type (R) and seashores nested within reef types (S(R)). Analyses completed separately for upper versus lower surfaces, and for the 5 (total *df* = 116) and 6 year (total *df* = 78) sampling times. Significant results (α = 0.05) are shown in bold, with MC = *p*-value used from Monte Carlo tests

		Surface:	**Upper**		**Lower**	
Measure	**Years**	**Factor**	**Pseudo-*F***	***p*-value**	**Pseudo-*F***	***p*-value**
Mobile invertebrate assemblage structure	5	R	1.13	0.4024	4.99	**0.016 (MC)**
		S(R)	1.02	0.4433	3.29	**0.0011**
	6	R	1.25	0.2896	1.46	0.2879 (MC)
		S(R)	2.56	**0.0002**	6.17	**0.0001**
Sessile assemblage structure	5	R	0.35	0.77 (MC)	1.12	0.41 (MC)
		S(R)	7.26	**0.0001**	1.64	0.17
	6	R	3.22	0.09 (MC)	1.62	0.29 (MC)
		S(R)	3.79	**0.0005**	2.38	0.05
Species richness	5	R	0.18	0.72 (MC)	0.06	0.83 (MC)
		S(R)	5.75	**0.0063**	8.13	**0.0009**
	6	R	12.04	0.07 (MC)	1.16	0.39 (MC)
		S(R)	0.24	0.78	2.88	0.07
Barnacle abundance	5	R	0.19	0.8012	0.37	0.7103 (MC)
		S(R)	3.98	**0.0027**	5.97	**0.0007**
	6	R	1.18	0.2849	0.58	0.5852 (MC)
		S(R)	3.08	**0.0057**	3.43	**0.0152**