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Electronic supplementary material

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Table 1: Geographical and structural details of the artificial coastal structures (n = 12) and natural rocky shores (n = 12) surveyed at locations around the coast of Wales, UK.

Location	Site	Structure	Lat	Lon
Aberystwyth	Aberystwyth Harbour	Artificial - Seawall	52.406252	-4.091895
	Aberystwyth North Beach	Natural	52.419521	-4.086048
Barry	Barry Docks	Artificial - Rock armour	51.390862	-3.261751
	Jackson's Bay Beach	Natural	51.388161	-3.263964
Borth	Borth Beach	Artificial - Rock armour*	52.485802	-4.053093
	Borth Beach	Natural*	51.388161	-3.263964
Colwyn Bay	Colwyn Bay Beach	Artificial - Seawall	53.293372	-3.698014
	Angel Bay Beach	Natural	53.327697	-3.775981
Dinas Dinlle	Dinas Dinlle Beach	Artificial - Rock armour	53.087384	-4.339081
	Llanddwyn Island (west)	Natural	53.139477	-4.413432
Fishguard	Goodwick Harbour	Artificial - Rock armour	52.002218	-4.988618
	Fishguard Lower Town Beach	Natural	51.998005	-4.973835
Llandundo	Llandudno West Shore Beach	Artificial - Rock armour	53.309028	-3.845042
	Little Orme/Llandudno Beach	Natural	53.325898	-3.786562
Nefyn	Nefyn Harbour	Artificial - Seawall	52.939038	-4.536034
	Nefyn Beach	Natural	52.941346	-4.536527
Porthcawl	Porthcawl Harbour	Artificial - Seawall	51.473052	-3.700518
	Porthcawl Trecco Bay Beach	Natural	51.474815	-3.689693
Porthgain	Porthgain Harbour	Artificial - Seawall	51.949003	-5.182656
	Trefin Beach	Natural	51.949508	-5.153611
Pwllheli	Pwllheli Harbour	Artificial - Rock armour	52.887236	-4.397732
	Llanddwyn Island (east)	Natural*	53.139301	-4.407015
Saundersfoot	Saundersfoot Harbour	Artificial - Seawall	51.709762	-4.695387
	Saundersfoot Beach	Natural	51.716858	-4.689586

*Sites that could not be surveyed by uncrewed aerial vehicle.

Table 2: Examples of ecologically relevant scales typically studied in relation to structural complexity and biodiversity on intertidal rocky shorelines.

Scale of feature studied	Typical area surveyed	Ecological relevance to rocky shores	Reference
1-10 mm	< 25 cm^2	Barnacle: settlement cues	Hills et al. (1998)
10-50 cm	25 cm-1 m^2	Limpet foraging excursions, macroalgae/mussel abundance	Hartnoll and Wright (1977); Archambault and Bourget (1996); Kostylev et al. (2005)
~ 1 m	~ 3 m^2	Hydrodynamic control of invertebrate diversity and biomass	Underwood and Chapman (1996); Guichard and Bourget (1998)
> 5 m	~ 100 m^2	Landscape processes	Archambault and Bourget (1996); Amatulli et al. (2018)

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Archambault P, Bourget E (1996) Scales of coastal heterogeneity and benthic intertidal species richness, diversity and abundance. Marine Ecology Progress Series 136: 111-121

Guichard F, Bourget E (1998) Topographic heterogeneity, hydrodynamics, and benthic community structure:a scale-dependent cascade. Marine Ecology Progress Series 171: 59-70

Hartnoll RG, Wright JR (1977) Foraging movements and homing in the limpet Patella vulgata L. Animal Behaviour 25: 806-810

Hills JM, Thomason JC, Milligan JL, Richardson M (1998) Do barnacle larvae respond to multiple settlement cues over a range of spatial scales? Recruitment, Colonization and Physical-Chemical Forcing in Marine Biological Systems: 101-111

Kostylev VE, Erlandsson J, Ming MY, Williams GA (2005) The relative importance of habitat complexity and surface area in assessing biodiversity: Fractal application on rocky shores. Ecological Complexity 2: 272-286

Underwood AJ, Chapman MG (1996) Scales of spatial patterns of distribution of intertidal invertebrates. Oecologia 107: 212-224

Table 3: Uncrewed aerial vehicle, camera and survey specifications.

Category	**Specification**
Brand	TOPCON
Model	Falcon 8 Octocopter
Weight	2000 g
Payload (max.)	800 g
Endurance	16 – 26 min
Radius (max.)	1 km
Camera	Sony A7R - 35 mm lens - (36 MP)
Frontal overlap	80 %
Side overlap	80 %
Height	40 m

Table 4: Summary of the mean difference (**Δ**) in surface rugosity between artificial structures (rock armour and seawalls) and natural rocky shores at 12 scales. Delta rugosity is accompanied by results from permutation tests (Z scores and p value). Bold p value indicates statistical significance.

Window	***Scale***	***Δ rugosity***	***Z***	***p***	***Δ rugosity***	***Z***	***p***
		Rock Armour vs Natural			*Seawall vs Natural*		
1 mm	Fine	-0.06	2.163	**< 0.05**	- 0.07	4.346	**< 0.05**
5 mm		-0.19	3.122	**< 0.05**	-0.15	3.748	**< 0.05**
10 mm		-0.37	3.573	**< 0.05**	-0.26	3.697	**< 0.05**
10 cm	Medium	-0.057	0.610	0.27	-0.269	2.695	**< 0.05**
20 cm		-0.136	0.816	0.21	-0.554	3.010	**< 0.05**
30 cm		0.0004	-0.026	0.97	-0.746	2.851	**< 0.05**
40 cm		0.2834	-1.267	0.10	-0.892	2.531	**< 0.05**
50 cm		0.700	-2.119	**< 0.05**	-0.963	2.147	**< 0.05**
1 m	Large	0.02594	1.487	0.068	-0.01207	1.106	0.134
2 m		0.00304	-0.115	0.908	-0.03775	1.389	0.082
5 m		-0.11176	1.376	0.084	-0.12207	1.734	**< 0.05**
10 m		-0.19720	1.585	**< 0.05**	-0.16019	1.517	**< 0.05**