

Supplementary material

Spatial and temporal variation of kelp forests and associated macroalgal assemblages along the Portuguese coast

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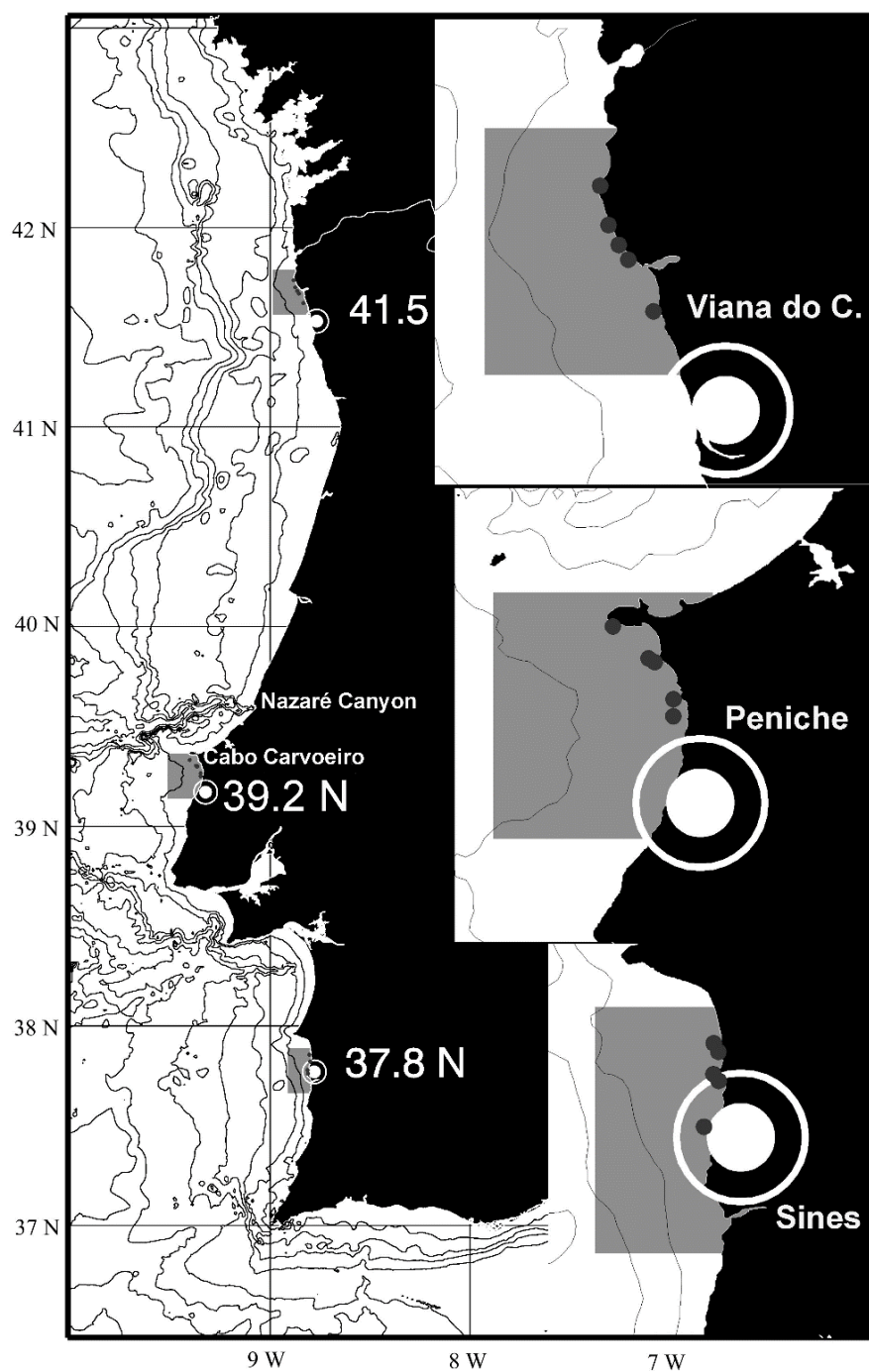


Fig. S1. Map of continental Portugal with sampling regions.

Table S1. Taxa distribution per region and climate affinity (CA: I, warm-water; II, cold-water; III, widely distributed)

	Viana do Castelo		Peniche		Sines		CA
	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	
Chlorophyta							
<i>Cladophora pellucida</i>			0.1100	0.09	0.4300	0.09	I
<i>Cladophora</i> sp.			0.1000	0.03	0.1400	0.03	III
<i>Cladophora</i> spp.			0.0100	0.02	0.0700	0.02	III
<i>Codium adhaerens</i>					14.9300	2.77	I
<i>Codium tomentosum</i>			0.4261	0.02	4.2672	1.38	III
<i>Codium vermilara</i>			4.2494	1.97	10.5543	3.53	III
Filamentous (undetermined)			3.3900	1.97	0.6300	0.13	III
<i>Monostroma grevillei</i>			0.0001	0.19	0.6800	0.19	III
<i>Ulva clathrata</i>	0.0439	0.03					III
<i>Ulva lactuca</i>					<0.0001	0.00	III
<i>Ulva rigida</i>	0.0416	0.02	0.0076	0.02			III
<i>Ulva</i> sp.	0.0006	0.00	0.0210	0.02	0.0557	0.02	III
Rhodophyta							
<i>Acrosorium ciliolatum</i>	0.0142	0.23	6.1208	1.13	0.0427	1.13	III
<i>Acrosorium venulosum</i>	0.4300	0.25	0.7600	0.31	0.0100	0.31	III
<i>Aglaothamnion byssoides</i>			0.0083	0.01			III
<i>Aglaothamnion</i> sp.			0.0500	0.03	0.0100	0.03	III
<i>Ahnfeltiopsis devoniensis</i>	0.0014	0.00					II
<i>Ahnfeltia plicata</i>	<0.0001	0.00					II
<i>Anotrichium furcellatum</i>			0.0003	0.00	0.0009	0.00	III
<i>Asparagopsis armata</i>			64.77	10.29	4.72	10.30	III
<i>Apoglossum ruscifolium</i>			<0.0001	0.00	<0.0001	0.00	III
<i>Bonnemaisonia asparagoides</i>			0.2600	0.13	0.4000	0.10	III
<i>Bornetia secundiflora</i>			0.0700	0.04	0.0100	0.04	I
<i>Bornetia</i> spp.					<0.0001	0.00	I
<i>Calliblepharis ciliata</i>	9.5259	2.27	0.0021	2.25			II
<i>Ceramium ciliatum</i>			0.1100	0.08	0.1300	0.08	III
<i>Ceramium echionotum</i>					0.0006	0.00	III
<i>Ceramium virgatum</i>	0.0064	0.00	0.0001	0.00			II
<i>Ceramium</i> sp.			0.0103	0.01			III
<i>Ceramium</i> spp.	0.0001	0.11	0.0197	0.11	0.5714	0.11	III
<i>Champia parvula</i>			0.0670	0.02	0.0511	0.02	III
<i>Chondracanthus acicularis</i>	1.2210	0.29	0.4964	0.30	0.3809	0.30	III
<i>Chondracanthus teedei</i>	1.9479	0.53	0.0003	0.46	0.0110	0.46	III

	Viana do Castelo		Peniche		Sines		CA
	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	
<i>Chondria scintillans</i>	0.2499	0.12					
<i>Chondria coeruleascens</i>	2.3212	1.32	0.0532	0.03			III
<i>Chondria dasyphylla</i>	4.3767	1.40	0.3038	1.40	0.4020	1.40	III
<i>Chondrus crispus</i>	19.6974	4.17			0.0012	3.76	II
<i>Corallina officinalis</i>	0.3348	0.23	2.7873	1.63	0.7362	1.63	III
<i>Corallina elongata</i>			0.3000	0.48	3.6100	0.55	III
<i>Cordylecladia erecta</i>	0.0793	0.03					III
<i>Cryptonemia lomation</i>	2.3459	0.93					I
<i>Cryptopleura ramosa</i>	7.9553	1.14	0.0509	0.64	0.0339	0.64	III
<i>Drachiella heterocarpa</i>					0.0253	0.01	II
<i>Drachiella spectabilis</i>	0.7820	1.22	0.0057	0.22			II
<i>Drachiella</i> spp.			0.0100	0.01			II
<i>Dilsea carnosa</i>	36.6047	5.86					II
<i>Dudresnaya verticillata</i>					0.0018	0.00	III
<i>ErythroGLOSSUM laciniatum</i>	7.4949	1.48	0.0253	1.48	0.0001	1.48	III
<i>Falkenbergia rufolanosa</i> phase			0.40	0.33	1.23	0.30	I
<i>Gayliella flácida</i>			0.0012	0.00			III
<i>Gelidium corneum</i>	9.1889	3.32	0.1090	3.32			III
<i>Gelidium pusillum</i>			0.0100	0.00			III
<i>Gelidium</i> spp.	0.4839	0.00	<0.0001	0.00			III
<i>Gracilaria multipartita</i>	0.1371	0.09					I
<i>Griffithsia</i> sp.					0.0001	0.00	III
<i>Griffithsia</i> spp.			0.1116	0.04	0.0367	0.01	III
<i>Gymnogongrus crenulatus</i>	1.2652	0.31	0.0200	0.18	0.0051	0.18	I
<i>Kallymenia reniformis</i>	0.5956	0.17	0.0002	0.17			III
<i>Halopithys incurva</i>			0.4500	0.14			I
<i>Halurus equisetifolius</i>			0.1511	0.03	0.0052	0.03	III
<i>Heterosiphonia plumosa</i>	0.7729	0.42	0.8528	0.16	0.0388	0.13	II
<i>Hypoglossum hypoglossoides</i>	0.9278	0.18	0.0194	0.17	0.0001	0.17	III
<i>Jania rubens</i>	0.0008	0.17	0.8999	0.18	0.4518	0.18	III
<i>Jania rubens</i> var. <i>corniculata</i>					0.0221	0.01	I
<i>Liagora distenta</i>					0.0234	0.01	I
<i>Liagora víscida</i>					0.0016	0.00	I
<i>Lithophyllum incrustans</i>	1.9126	2.49	21.3972	2.58	12.1498	2.10	III
<i>Lomentaria articulata</i>	0.0733	0.03					III
<i>Lomentaria clavellosa</i>			<0.0001	0.00	<0.0001	0.00	III

	Viana do Castelo		Peniche		Sines		CA
	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	
<i>Lomentaria orcadensis</i>	0.0084	0.00					II
<i>Microcladia glandulosa</i>					0.0037	0.00	III
<i>Monosporus pedicellatus</i>			<0.0001	0.00	<0.0001	0.00	III
<i>Nitophyllum punctatum</i>	0.0007	0.06	0.3757	0.08	0.0793	0.07	III
<i>Osmundea pinnatifida</i>			0.0027	0.00	0.0053	0.00	I
<i>Palmaria palmata</i>	0.1188	0.08					II
<i>Peyssonnelia atropurpurea</i>	0.0739	0.03	0.0142	0.01			III
<i>Peyssonnelia harveyana</i>			0.0448	0.19	4.9408	0.70	III
<i>Peyssonnelia rubra</i>			0.4000	0.14			III
<i>Phyllophora crispa</i>	16.6109	2.77	0.8140	0.70	0.1557	0.70	II
<i>Phyllophora sícula</i>	0.4800	0.31					III
<i>Plocamium cartilagineum</i>	9.5268	4.48	35.3076	4.48	5.8370	3.17	III
<i>Plumaria plumosa</i>	0.0002	0.00					III
<i>Polyneura bonnemaisonii</i>	0.2300	0.08					III
<i>Polysiphonia denudata</i>	0.5696	0.21	0.3241	0.21	0.0582	0.21	III
<i>Polysiphonia fucoides</i>	0.0034	0.00					II
<i>Polysiphonia nigra</i>			0.0010	0.00			III
<i>Polysiphonia</i> sp.	<0.0001	0.01	0.0300	0.01	0.0100	0.01	III
<i>Polysiphonia</i> spp.	0.0300	0.15	<0.0001	0.15	1.1400	0.20	III
<i>Pterosiphonia ardreana</i>	0.1194	0.07	0.3984	0.09	0.0039	0.09	II
<i>Pterosiphonia complanata</i>	0.0162	0.67	10.2170	1.11	0.3695	1.00	I
<i>Pterosiphonia parasítica</i>			0.0500	0.01	<0.0001	0.00	III
<i>Pterosiphonia pennata</i>	0.0052	0.00	0.0259	0.02			I
<i>Pterosiphonia</i> spp.	0.7207	0.25	0.3556	0.10			III
<i>Pterothamnion plúmula</i>	0.6817	0.36	0.0001	0.00			II
<i>Pterothamnion crispum</i>			<0.0001	0.00	<0.0001	0.00	I
<i>Pterothamnion</i> spp.			<0.0001	0.00	<0.0001	0.00	III
<i>Radicilingua thysanorhizans</i>			<0.0001	0.00			I
<i>Rhodophyllis divaricata</i>			0.0800	0.04	<0.0001	0.04	III
<i>Rhodymenia holmesii</i>	7.4716	1.29	0.4313	1.29	0.0733	1.29	I
<i>Rhodymenia pseudopalmata</i>	8.9422	1.59	1.3316	0.84	0.0334	0.70	III
<i>Scinaia furcellata</i>	0.0519	0.03					III
<i>Sphaerococcus coronopifolius</i>					22.3300	3.55	III
<i>Sphondylothamnion multifidum</i>	0.3200	0.13	<0.0001	0.00	<0.0001	0.00	III
Ochrophyta							
<i>Carpomitra costata</i>			0.0038	0.00			I

	Viana do Castelo		Peniche		Sines		CA
	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	Mean biomass (g)	s.e.	
<i>Cladostephus spongiosus</i>			0.5634	0.28	0.0872	0.28	III
<i>Colpomenia peregrina</i>			0.0028	0.00			III
<i>Cystoseira baccata</i>			0.5100	0.15			III
<i>Cystoseira tamariscifolia</i>			0.0957	0.04			I
<i>Cystoseira nodicaulis</i>					0.2608	0.07	I
<i>Cystoseira</i> sp.					0.0506	0.02	III
<i>Cutleria adspersa</i>					0.0917	0.04	I
<i>Desmarestia aculeata</i>	0.2542	0.17					II
<i>Desmarestia ligulata</i>	0.1200	0.06	<0.0001	0.04			II
<i>Dictyopteris membranacea</i>	0.5489	0.14	0.0298	0.10	0.0299	0.10	III
<i>Dictyota dichotoma</i>	7.4766	2.87	17.1831	3.29	29.6606	4.04	III
Ectocarpales			0.0100	0.01	3.1700	2.07	III
<i>Halopteris filicina</i>			0.7092	1.96	7.9744	1.95	I
<i>Halopteris scoparia</i>			1.6400	0.83	8.8500	1.63	III
<i>Laminaria hyperborea</i>	85.6679	12.74					II
<i>Petalonia fáschia</i>			0.0098	0.01			III
<i>Phyllariopsis brevipes</i>	4.9754	1.21	0.0780	1.21	0.1141	1.21	I
<i>Ralfsia verrucosa</i>			0.1700	0.28	1.0300	0.28	III
<i>Saccorhiza polyschides</i>	14.7894	4.00	0.0087	3.00	1.0123	4.00	II
<i>Sargassum vulgare</i>					0.1210	0.06	I
<i>Spatoglossum solieri</i>			0.0307	0.02	0.1384	0.04	I
<i>Taonia atomaria</i>			0.1100	0.50	2.5700	0.50	III
<i>Zanardinia prototypus</i>	3.6671	1.10	2.1978	1.13	0.3731	1.13	I
Total biomass	274.3143		182.5749		147.4452		
Number of taxa							
I	10		18		21		
II	18		10		6		
III	36		64		55		
Total number of taxa	64		92		82		
Percentage (%)							
I	15.6		19.6		25.6		
II	28.1		10.9		7.3		
III	56.3		69.6		67.1		