

Supplementary Material

Seasonal variation in the composition and antioxidant potential of *Codium tomentosum* and *Ulva lacinulata* produced in a land-based integrated multi-trophic aquaculture system

Carla Sousa^{1,2}, Isabel Sousa-Pinto^{1,2}, Inês Oliveira³, Gonçalo Silva Marinho^{1,2*}

¹Department of Biology, Faculty of Sciences, University of Porto, Rua do Campo Alegre s/n, 4169-007 Porto, Portugal

²CIIMAR/CIMAR LA, Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Terminal de Cruzeiros do Porto de Leixões, 4450-208 Matosinhos, Portugal

³ALGAplus - Production and Trading of Seaweed and Derived Products, SA, Ílhavo, Portugal

* Corresponding author: goncalo.marinho@ciimar.up.pt

Supplementary Figures

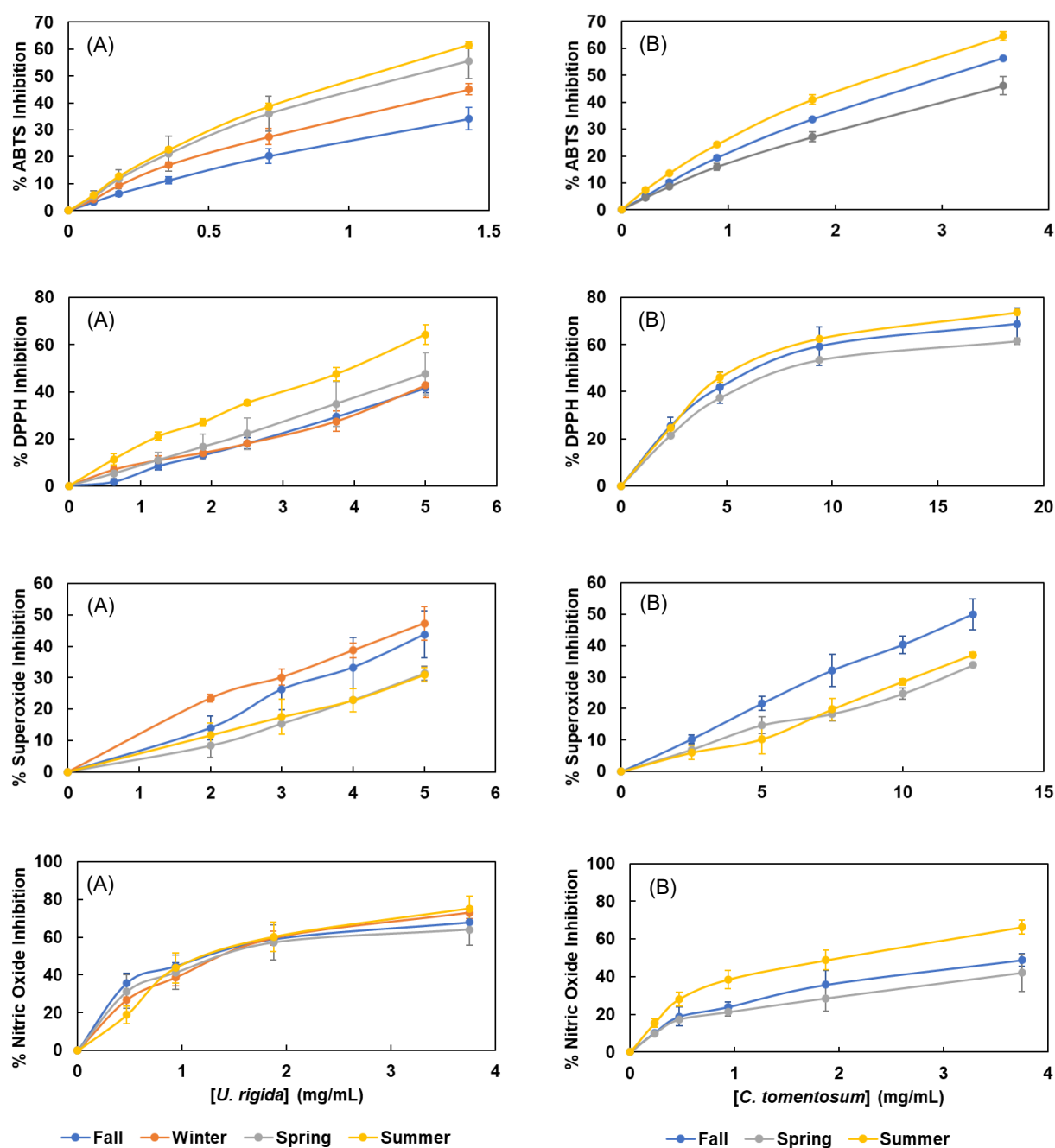


Figure S1. Dose-response curves for hydro-ethanolic extracts of *Ulva lacinulata* (A) and ethanolic extracts of *Codium tomentosum* (B) against ABTS^{•+}, DPPH, O₂^{•-} and •NO.

Supplementary tables

Table S1. Phytochemical composition of *U. lacinulata* and *C. tomentosum*. PERMANOVA tests of phytochemical composition in the two species harvested at different seasons, using Euclidian distances. Significant differences in bold.

Total Chlorophyll						
<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	113.4	113.4	178.66	0.0001	9843
Season	3	40.226	13.409	21.124	0.0002	9950
Species x Season	2	0.90906	0.45453	0.71607	0.5094	9969
Residual	11	6.9824	0.63476			
<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>			
fall, winter	3.0168	0.050	280			
fall, spring	0.77766	0.4764	6863			
fall, summer	8.6137	0.0019	6847			
winter, spring	1.4729	0.2342	280			
winter, summer	6.8799	0.0042	280			
spring, summer	5.3749	0.0061	6831			

^a Pairwise test on term “Season”

Carotenoids						
<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	3.1729	3.1729	272.68	0.0001	9829
Season	3	1.2586	0.41953	36.055	0.0001	9962
Species x Season	2	0.062742	0.031371	2.696	0.1139	9946
Residual	11	0.128	0.011636			
<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>			
fall, winter	3.9574	0.0115	280			
fall, spring	1.66	0.1545	6787			
fall, summer	6.6147	0.0032	6820			
winter, spring	2.3081	0.0586	279			
winter, summer	8.1122	0.0049	280			

spring, summer 7.0511 **0.0026** 6782

^a Pairwise test on term “Season”

Phenols

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	0.88666	0.88666	90.086	0.0001	9838
Season	3	0.42992	0.14331	14.56	0.0013	9949
Species x Season	2	0.12068	0.06034	6.1307	0.0143	9950
Residual	11	0.10827	0.0098423			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	6.3821		10	0.0089		
Ulva, Codium (spring)	8.2611		10	0.0038		
Ulva, Codium (summer)	2.9258		10	0.0582		
fall, winter (Ulva)	0.41603		10	0.7021		
fall, spring (Ulva)	3.4631		10	0.0271		
fall, summer (Ulva)	3.4828		10	0.0261		
winter, spring (Ulva)	3.6176		10	0.0204		
winter, summer (Ulva)	3.4869		10	0.0243		
spring, summer (Ulva)	1.0177		10	0.3663		
fall, spring (Codium)	2.5932		3	0.1215		
fall, summer (Codium)	6.5714		3	0.0247		
spring, summer (Codium)	6.4245		3	0.0261		

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Table S2. Macrochemical composition of *U. lacinulata* and *C. tomentosum*. PERMANOVA tests of macrochemical composition in the two species harvested at different seasons, using Euclidian distances. Significant differences in bold.

Moisture

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	242.06	242.06	147.27	0.0001	9846
Season	3	21.381	7.1271	4.3362	0.0261	9951

Species x Season	2	19.979	9.9893	6.0776	0.0122	9953
Residual	11	18.08	1.6436			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	7.6132		10	0.0048		
Ulva, Codium (spring)	11.751		10	0.0008		
Ulva, Codium (summer)	3.891		10	0.0298		
fall, winter (Ulva)	4.3858		7	0.0129		
fall, spring (Ulva)	2.9838		9	0.0384		
fall, summer (Ulva)	2.7228		10	0.0491		
winter, spring (Ulva)	2.8991		7	0.0419		
winter, summer (Ulva)	0.54554		6	0.6138		
spring, summer (Ulva)	0.58693		10	0.5947		
fall, spring (Codium)	2.6833		3	0.1181		
fall, summer (Codium)	1.857		3	0.2039		
spring, summer (Codium)	0.78446		2	0.5166		

^a Pairwise test on term "Species x Season"

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Protein

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	280.12	280.12	97.306	0.0001	9836
Season	3	126.26	42.087	14.62	0.0002	9958
Species x Season	2	36.501	18.251	6.3397	0.017	9948
Residual	11	31.667	2.8788			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	3.7639		10	0.0329		
Ulva, Codium (spring)	4.1516		10	0.0248		
Ulva, Codium (summer)	8.6818		10	0.0044		
fall, winter (Ulva)	1.1526		10	0.3101		
fall, spring (Ulva)	3.1414		10	0.0324		
fall, summer (Ulva)	1.3673		9	0.237		
winter, spring (Ulva)	2.6388		10	0.0579		
winter, summer (Ulva)	0.60078		10	0.5704		

spring, summer (Ulva)	2.0579	10	0.1075
fall, spring (Codium)	4.3132	3	0.0517
fall, summer (Codium)	4.3767	3	0.045
spring, summer (Codium)	0.11879	3	0.9225

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Lipids

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	40.575	40.575	20.246	0.0011	9944
Season	3	6.6808	2.2269	1.1112	0.4146	9974
Species x Season	2	4.8339	2.417	1.206	0.358	9959
Residual	11	22.045	2.0041			

Ash

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	1180.8	1180.8	62.458	0.0001	9838
Season	3	297.77	99.258	5.2504	0.0131	9952
Species x Season	2	254.87	127.44	6.7409	0.0061	9961
Residual	11	207.95	18.905			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	15.534		10	0.0007		
Ulva, Codium (spring)	14.923		10	0.0005		
Ulva, Codium (summer)	4.0274		10	0.0305		
fall, winter (Ulva)	1.6106		10	0.1845		
fall, spring (Ulva)	6.9196		10	0.0024		
fall, summer (Ulva)	1.2856E-08		10	1		
winter, spring (Ulva)	2.2219		10	0.0928		
winter, summer (Ulva)	1.2615		10	0.2717		
spring, summer (Ulva)	4.1631		10	0.0133		
fall, spring (Codium)	16.428		3	0.0037		
fall, summer (Codium)	2.1051		3	0.1706		

spring, summer (Codium) 0.81264 3 0.5041

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Fiber

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	1028.3	1028.3	36.712	0.0005	9833
Season	3	145.94	48.648	1.7368	0.2143	9946
Species x Season	2	126.45	63.224	2.2572	0.1497	9950
Residual	11	308.11	28.01			

Fatty Acids

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	37.856	37.856	19.428	0.0009	9848
Season	3	22.757	7.5856	3.8929	0.0434	9959
Species x Season	2	2.3136	1.1568	0.59367	0.5866	9963
Residual	11	21.434	1.9486			
<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>			
fall, winter	1.2477	0.2599	175			
fall, spring	2.1654	0.0702	5377			
fall, summer	2.2846	0.0809	5241			
winter, spring	2.4091	0.0852	280			
winter, summer	2.6481	0.0451	280			
spring, summer	1.1006	0.3148	6826			

^a Pairwise test on term “Season”

SFA (% of total)

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	649.16	649.16	97.865	0.0001	9844
Season	3	333.68	111.23	16.768	0.0004	9962
Species x Season	2	7.9228	3.9614	0.5972	0.5601	9956
Residual	11	72.965	6.6332			

<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>
fall, winter	2.0004	0.0808	175
fall, spring	3.2734	0.0256	5280
fall, summer	3.4476	0.0141	5282
winter, spring	4.1788	0.009	280
winter, summer	0.069332	0.936	280
spring, summer	9.8062	0.0008	6843

^a Pairwise test on term “Season”

MUFA (% of total)

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	86.498	86.498	4.0059	0.0679	9841
Season	3	816.75	272.25	12.609	0.0018	9966
Species x Season	2	228.07	114.03	5.2811	0.0301	9971
Residual	11	237.52	21.592			

<i>Pairwise test^a</i>	<i>t</i>	<i>Unique perms</i>	<i>P(MC)^b</i>
Ulva, Codium (fall)	1.7524	10	0.1794
Ulva, Codium (spring)	0.94586	10	0.4148
Ulva, Codium (summer)	18.359	10	0.0002
fall, winter (Ulva)	0.65003	10	0.55
fall, spring (Ulva)	1.042	10	0.3546
fall, summer (Ulva)	6.7804	10	0.0024
winter, spring (Ulva)	1.0928	10	0.3345
winter, summer (Ulva)	2.1446	10	0.0961
spring, summer (Ulva)	1.7854	10	0.152
fall, spring (Codium)	4.0538	3	0.0565
fall, summer (Codium)	29.649	3	0.0014
spring, summer (Codium)	116.71	3	0.0001

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

PUFA (% of total)

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	1209.6	1209.6	138.87	0.0001	9944
Season	3	188.18	62.728	7.202	0.081	9985
Species x Season	2	174.83	87.415	10.036	0.0349	9979
Residual	11	95.808	8.7098			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	9.6395		10	0.0024		
Ulva, Codium (spring)	2.7822		10	0.0684		
Ulva, Codium (summer)	12.194		10	0.001		
fall, winter (Ulva)	Negative ^c					
fall, spring (Ulva)	2.0315		10	0.1143		
fall, summer (Ulva)	1.3568		10	0.2471		
winter, spring (Ulva)	0.21573		7	0.6432		
winter, summer (Ulva)	Negative ^c					
spring, summer (Ulva)	1.1745		10	0.3037		
fall, spring (Codium)	1.8796		3	0.1975		
fall, summer (Codium)	10.147		3	0.0098		
spring, summer (Codium)	4.8287		3	0.0445		

^a Pairwise test on term "Species x Season"

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

^c PUFA quantified in one single replicate in the winter samples, test result below the limit of quantification for other replicates

Sodium

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	16718	16718	276.66	0.0001	9837
Season	3	4457.8	1485.9	24.59	0.0003	9954
Species x Season	2	204.65	102.32	1.6933	0.2246	9953
Residual	11	664.71	60.429			
<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>			
fall, winter	4.4423	0.0044	279			
fall, spring	8.7312	0.0018	6886			
fall, summer	2.8998	0.0252	6833			

winter, spring	3.4962	0.0132	280
winter, summer	1.8219	0.1404	280
spring, summer	4.6449	0.0038	6849

^a Pairwise test on term “Season”

Magnesium

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	3089.5	3089.5	132.23	0.0001	9839
Season	3	634.69	211.56	9.0548	0.0012	9964
Species x Season	2	220.12	110.06	4.7105	0.036	9959
Residual	11	257.01	23.365			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	9.8403		10	0.002		
Ulva, Codium (spring)	32.475		10	0.0001		
Ulva, Codium (summer)	4.273		10	0.0253		
fall, winter (Ulva)	3.2314		10	0.0291		
fall, spring (Ulva)	9.6191		10	0.0014		
fall, summer (Ulva)	2.2579		10	0.0865		
winter, spring (Ulva)	23.42		10	0.0001		
winter, summer (Ulva)	3.0965		10	0.0355		
spring, summer (Ulva)	0.090825		10	0.9328		
fall, spring (Codium)	1.64		3	0.2337		
fall, summer (Codium)	1.9954		3	0.183		
spring, summer (Codium)	0.36711		3	0.7491		

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Potassium

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	6172.4	6172.4	309.66	0.0001	9831
Season	3	4058.5	1352.8	67.869	0.0001	9950
Species x Season	2	1477.9	738.94	37.071	0.0001	9933

Residual	11	219.26	19.933	
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>
Ulva, Codium (fall)	6.0672		10	0.0078
Ulva, Codium (spring)	12.594		10	0.0016
Ulva, Codium (summer)	8.2516		10	0.0036
fall, winter (Ulva)	1.4285		10	0.2264
fall, spring (Ulva)	5.5893		10	0.0045
fall, summer (Ulva)	1.532		10	0.1954
winter, spring (Ulva)	6.3929		10	0.0038
winter, summer (Ulva)	0.72935		10	0.5061
spring, summer (Ulva)	3.8792		10	0.0189
fall, spring (Codium)	10.8		3	0.006
fall, summer (Codium)	5.3262		3	0.0347
spring, summer (Codium)	4.1366		3	0.0565

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Calcium

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	17.301	17.301	54.226	0.0001	9859
Season	3	16.608	5.5359	17.351	0.0003	9960
Species x Season	2	0.98794	0.49397	1.5482	0.2559	9960
Residual	11	3.5096	0.31905			
<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>			
fall, winter	7.4166	0.0032	280			
fall, spring	5.2782	0.0037	6808			
fall, summer	2.9715	0.0489	6844			
winter, spring	4.1897	0.0103	280			
winter, summer	3.1441	0.0317	280			
spring, summer	0.83171	0.4294	6832			

^a Pairwise test on term “Season”

Table S3. Microchemical composition of *U. lacinulata* and *C. tomentosum*. PERMANOVA tests of microchemical composition in the two species harvested at different seasons, using Euclidian distances. Significant differences in bold.

Iron						
<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	41663	41663	0.51109	0.5089	9865
Season	3	1.5718E+06	5.2392E+05	6.4272	0.0106	9950
Species x Season	2	19512	9755.9	0.11968	0.898	9963
Residual	11	8.9669E+05	81517			
<i>Pairwise test^a</i>	<i>t</i>	<i>P(perm)</i>	<i>Unique perms</i>			
fall, winter	0.51821	0.5928	280			
fall, spring	1.9873	0.092	6866			
fall, summer	2.6804	0.0399	6826			
winter, spring	3.7649	0.0092	280			
winter, summer	20.779	0.0052	280			
spring, summer	0.8888	0.4787	6828			
^a Pairwise test on term “Season”						
Iodine						
<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	302.06	302.06	2.3654	0.1585	9844
Season	3	8382.7	2794.2	21.881	0.0001	9963
Species x Season	2	5545.8	2772.9	21.714	0.0001	9951
Residual	11	1404.7	127.7			
<i>Pairwise test^a</i>	<i>t</i>			<i>Unique perms</i>	<i>P(MC)^b</i>	
Ulva, Codium (fall)	3.519			10	0.0409	
Ulva, Codium (spring)	4.0323			10	0.0284	
Ulva, Codium (summer)	3.5071			10	0.0368	
fall, winter (Ulva)	0.44439			10	0.6873	
fall, spring (Ulva)	0.95072			10	0.3909	
fall, summer (Ulva)	2.1765			10	0.0916	

winter, spring (Ulva)	1.7554	10	0.1507
winter, summer (Ulva)	4.1317	10	0.0143
spring, summer (Ulva)	1.1395	10	0.3238
fall, spring (Codium)	4.0793	3	0.0548
fall, summer (Codium)	3.8994	3	0.0573
spring, summer (Codium)	2.2717	3	0.1542

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Total Arsenic

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	1002.6	1002.6	271.79	0.0001	9841
Season	3	190.74	63.581	17.236	0.0001	9959
Species x Season	2	157.92	78.961	21.405	0.0001	9965
Residual	11	40.578	3.6889			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	8.9153		10	0.0026		
Ulva, Codium (spring)	7.7791		10	0.0045		
Ulva, Codium (summer)	14.156		10	0.0014		
fall, winter (Ulva)	5.8144		10	0.0052		
fall, spring (Ulva)	1.0109		10	0.3653		
fall, summer (Ulva)	1.9256		10	0.1259		
winter, spring (Ulva)	13.593		10	0.0001		
winter, summer (Ulva)	8.8229		10	0.0006		
spring, summer (Ulva)	10.67		10	0.0006		
fall, spring (Codium)	3.8215		3	0.0606		
fall, summer (Codium)	2.7619		3	0.1067		
spring, summer (Codium)	2.2348		3	0.1579		

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Inorganic Arsenic (% of total)

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
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Species	1	137.68	137.68	48.043	0.0001	9841
Season	3	278.93	92.976	32.444	0.0002	9952
Species x Season	2	167.32	83.658	29.193	0.0001	9963
Residual	11	31.523	2.8657			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	5.4354		10	0.0108		
Ulva, Codium (spring)	12.21		10	0.0012		
Ulva, Codium (summer)	15.44		10	0.0006		
fall, winter (Ulva)	2.9923		10	0.0415		
fall, spring (Ulva)	6.6474		10	0.003		
fall, summer (Ulva)	7.54		10	0.0019		
winter, spring (Ulva)	18.484		10	0.0001		
winter, summer (Ulva)	23.931		10	0.0001		
spring, summer (Ulva)	16.052		10	0.0002		
fall, spring (Codium)	4.348		3	0.0453		
fall, summer (Codium)	5.8253		3	0.0257		
spring, summer (Codium)	2.7287		3	0.1166		

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Cadmium

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Season	3	0.05292	0.01764	60.463	0.0002	2428
Residual	8	0.002334	0.00029175			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
fall, winter	2.8243		7	0.0465		
fall, spring	7.4246		6	0.0011		
fall, summer	10.002		5	0.0003		
winter, spring	5.3637		10	0.0055		
winter, summer	8.8703		7	0.001		
spring, summer	5.3033		7	0.0063		

^a Pairwise test on term “Season” (one-way PERMANOVA)

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Lead

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	2.288	2.288	2.0871	0.1917	9841
Season	3	3.4152	1.1384	1.0384	0.4461	9954
Species x Season	2	4.0579	2.029	1.8508	0.1987	9953
Residual	11	12.059	1.0963			

Table S4. Antioxidant potential of *U. lacinulata* and *C. tomentosum*. PERMANOVA tests of radical scavenging capacity of the extracts of the two species harvested at different seasons, using Euclidian distances. Significant differences in bold.

ABTS IC₂₅

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	1.5799	1.5799	167.27	0.0001	9845
Season	3	0.51756	0.17252	18.265	0.0005	9961
Species x Season	2	0.48998	0.24499	25.937	0.0001	9953
Residual	11	0.1039	0.0094456			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	3.2026		10	0.0496		
Ulva, Codium (spring)	9.3752		10	0.0027		
Ulva, Codium (summer)	18.86		10	0.0007		
fall, winter (Ulva)	3.6391		10	0.0225		
fall, spring (Ulva)	4.7552		10	0.008		
fall, summer (Ulva)	7.6399		10	0.0014		
winter, spring (Ulva)	2.0061		10	0.1159		
winter, summer (Ulva)	4.5298		10	0.0103		
spring, summer (Ulva)	0.58187		10	0.588		
fall, spring (Codium)	3.6996		3	0.0687		
fall, summer (Codium)	8.2283		3	0.0165		
spring, summer (Codium)	6.6121		3	0.0227		

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

DPPH IC₂₅

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	0.017031	0.017031	0.060762	0.8115	9816
Season	3	6.7252	2.2417	7.9978	0.0051	9960
Species x Season	2	2.7722	1.3861	4.9452	0.0303	9960
Residual	11	3.0832	0.28029			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	2.1296		10	0.1237		
Ulva, Codium (spring)	0.69161		10	0.5426		
Ulva, Codium (summer)	5.9782		10	0.0095		
fall, winter (Ulva)	0.50163		10	0.6436		
fall, spring (Ulva)	1.9921		10	0.1106		
fall, summer (Ulva)	4.5665		10	0.0103		
winter, spring (Ulva)	2.8058		10	0.046		
winter, summer (Ulva)	7.1173		10	0.0022		
spring, summer (Ulva)	1.8495		10	0.1356		
fall, spring (Codium)	1.4336		3	0.2855		
fall, summer (Codium)	0.10048		3	0.9252		
spring, summer (Codium)	5.7743		3	0.0296		

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Superoxide IC₂₅

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	69.182	69.182	235.63	0.0001	9841
Season	3	23.696	7.8987	26.902	0.0004	9957
Species x Season	2	5.4216	2.7108	9.2327	0.0028	9958
Residual	11	3.2297	0.29361			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium	3.6996		10	0.0327		

Ulva, Codium (spring)	18.449	10	0.0006
Ulva, Codium (summer)	10.235	10	0.0012
fall, winter (Ulva)	1.7508	10	0.1585
fall, spring (Ulva)	2.2588	10	0.0826
fall, summer (Ulva)	1.9626	10	0.1237
winter, spring (Ulva)	12.106	10	0.0003
winter, summer (Ulva)	6.6365	10	0.003
spring, summer (Ulva)	0.11656	10	0.9124
fall, spring (Codium)	6.0474	3	0.0279
fall, summer (Codium)	4.3537	3	0.0433
spring, summer (Codium)	1.8299	3	0.2064

^a Pairwise test on term “Species x Season”

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations

Nitric Oxide IC₂₅

<i>Main test</i>	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>Pseudo-F</i>	<i>P(perm)</i>	<i>Unique perms</i>
Species	1	1.0742	1.0742	23.82	0.0008	9848
Season	3	0.61084	0.20361	4.5152	0.0172	9964
Species x Season	2	1.2067	0.60333	13.379	0.0004	9955
Residual	11	0.49605	0.045095			
<i>Pairwise test^a</i>	<i>t</i>		<i>Unique perms</i>	<i>P(MC)^b</i>		
Ulva, Codium (fall)	7.3635		10	0.0055		
Ulva, Codium (spring)	3.4071		10	0.0412		
Ulva, Codium (summer)	2.7492		10	0.0708		
fall, winter (Ulva)	2.1642		10	0.0947		
fall, spring (Ulva)	0.96268		10	0.3882		
fall, summer (Ulva)	4.1357		10	0.0146		
winter, spring (Ulva)	0.53772		10	0.6159		
winter, summer (Ulva)	3.4525		10	0.0269		
spring, summer (Ulva)	2.9442		10	0.0416		
fall, spring (Codium)	1.3004		3	0.3174		
fall, summer (Codium)	5.5264		3	0.0312		

spring, summer (Codium)	2.5594	3	0.1201
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^a Pairwise test on term "Species x Season"

^b Monte Carlo (MC) tests were used to obtain p-values due to few possible permutations