

Stepien, Pfister & Wootton – Carbon access traits in macrophytes

S3 Table. Mean pH* and $\delta^{13}\text{C}$ for 111 species from Phylum Rhodophyta. Species data are compiled and averaged by family membership into 30 families for ancestral state reconstruction and stochastic character mapping. Mean species pH* and $\delta^{13}\text{C}$ are taken from a meta analysis of 76 studies [13]. † indicates data from this study contributed to the species means. * indicates that the value \pm standard error is not significantly different from a cutoff point, and thus is ruled as not having a CCM. Families in which at least one member has a CCM were designated as having CCMs. Grey shading indicates families, species and data that are categorized as having CCMs based on the given metric. The cutoff for CCM presence in individual species was pH* > 9.05 and/or $\delta^{13}\text{C}$ > -30‰. Missing data are indicated by a dash (-). Ambiguous pH* data (8.90-9.05) that lacked $\delta^{13}\text{C}$ data were excluded from the dataset (line strikethrough).

family	CCM in at least one family member	Mean family pH*	Total n	% of species with CCM	% of species without CCM	species	mean species pH*	mean species $\delta^{13}\text{C}$ (‰)	species CCM by pH* / $\delta^{13}\text{C}$
Balliaceae	no	8.76	1	-	-	<i>Ballia callitricha</i>	8.76	-32.86	no / no
Bangiaceae	yes	9.63	10	90%	10%	<i>Porphyra umbilicalis</i>	9.91	-20.20	yes / yes
						<i>Porphyra perforata</i>	9.84	-15.96	yes / yes
						<i>Porphyra fucicola</i>	9.80	-	yes/ -
						<i>Porphyra endiviifolium</i>	9.77	-24.13	yes / yes
						<i>Polysiphonia nigrescens</i>	9.70	-14.47	yes / yes
						<i>Porphyra papenfussii</i>	9.69	-	yes/ -
						<i>Porphyra</i> sp. 3 †	9.62	-	yes/ -
						<i>Polysiphonia fucoides</i>	9.60	-14.47	yes / yes
						<i>Porphyra torta</i>	9.55	-	yes/ -
						<i>Polysiphonia</i> sp. 4	8.78	-33.21	no / no
Bonnemaisoniaceae	no	8.89	1	-	-	<i>Bonnemaisonia nootkana</i>	8.89	-	no/ -
Ceramiaceae_Call	yes	9.03	2	50%	50%	<i>Callithamnion pikeanum</i> †	9.21	-31.11	yes / no
						<i>Euptilota articulata</i>	8.84	-31.96	no / no
Ceramiaceae_CerAnt	yes	9.86	3	100%	0%	<i>Ceramium pacificum</i>	10.25	-	/ -yes
						<i>Ceramium rubrum</i>	9.72	-18.06	yes / yes
						<i>Microcladia borealis</i> †	9.60	-20.22	yes / yes
						<i>Pterothamnion pectinatum</i>	8.97	-	no/-
Ceramiaceae_Grif	no	8.96	2	0%	100%	<i>Anotrichium crinitum</i>	8.98	-30.99	no/ no
						<i>Ptilota plumosa</i>	8.94	-33.66	no/ no
Champiaceae	yes	9.59	1	-	-	<i>Neogastroclonium subarticulatum</i>	9.59	-	yes/ -

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Corallinaceae	yes	9.05	8	63%	37%	<i>Corallina frondescens</i> †	9.59	-20.46	yes / yes
						<i>Bossiella</i> sp. 1 †	9.43	-15.33	yes / yes
						<i>Corallina vancouveriensis</i> †	9.34	-5.69	yes / yes
						<i>Corallina officinalis</i>	9.17	-13.85	yes / yes
						<i>Jania rosea</i>	8.92	-20.43	no / yes
						<i>Arthrocardia</i> sp. 1	8.86	-	no / -
						<i>Lithothamnion phymatodeum</i> †	8.64	-	no / -
						<i>Pseudolithophyllum whidbeyense</i> †	8.48	-	no / -
Cystocloniaceae	yes	8.92	3	33%	67%	<i>Cystoclonium purpureum</i>	9.40	-13.88	yes / yes
						<i>Craspedocarpus venosus</i>	8.79	-35.05	no / no
						<i>Rhodophyllis membranacea</i>	8.59	-31.75	no / no
Delesseriaceae_Delles	no	8.75	3	0%	100%	<i>Membranoptera alata</i>	8.79	-32.17	no / no
						<i>Hemineura frondosa</i>	8.76	-32.54	no / no
						<i>Delesseria sanguinea</i>	8.70	-33.51	no / no
Delesseriaceae_Phyco	no	8.75	8	0%	100%	<i>Polynura latissima</i>	8.98	-	no / -
						<i>Hymenena flabelligera</i>	8.89	-	no / -
						<i>Hymenena durvilleai</i>	8.85	-30.93	no / no
						<i>Hymenena multiloba</i> †	8.83	-31.77	no / no
						<i>Myriogramme gunniana</i>	8.79	-35.45	no / no
						<i>Halicnide similans</i>	8.74	-33.95	no / no
						<i>Phycodrys rubens</i>	8.70	-33.94	no / no
						<i>Cryptopleura ruprechtiana</i> †	8.64	-33.49	no / no
						<i>Schizoseris</i> sp. 1	8.59	-	no / -
Dumontiaceae	yes	9.57	6	100%	0%	<i>Dumontia contorta</i>	10.00	-14.40	yes / yes
						<i>Dumontia incrassata</i>	9.85	-	yes / -
						<i>Constantinea subulifera</i>	9.70	-	yes / -

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						<i>Dilsea carnosa</i>	9.40	-19.70	yes / yes
						<i>Dilsea pygmaea</i> †	9.32	-16.85	yes / yes
						<i>Weeksia coccinea</i> †	9.18	-20.27	yes / yes
Endocladiaceae	yes	9.43	1	-	-	<i>Endocladia muricata</i> †	9.43	-18.43	yes / yes
Fryellaceae	no	8.85	1	-	-	<i>Fryella gardneri</i>	8.85	-	no / -
Furcellariaceae	yes	9.12	2	50%	50%	<i>Furcellaria lumbricalis</i>	9.20	-20.99	yes / yes
						<i>Opuntia californica</i>	9.04	-33.33	no / no
Gigartiniaceae	yes	9.49	7	100%	0%	<i>Chondracanthus exasperatus</i>	9.71	-	yes / -
						<i>Iridaea cordata</i>	9.60	-17.00	yes / yes
						<i>Chondrus crispus</i>	9.56	-19.83	yes / yes
						<i>Mazzaella flaccida</i> †	9.49	-17.76	yes / yes
						<i>Mazzaella affinis</i> †	9.43	-20.69	yes / yes
						<i>Mazzaella splendens</i> †	9.36	-18.37	yes / yes
						<i>Mazzaella parksii</i> †	9.31	-22.72	yes / yes
Gracilariaceae	yes	9.30	6	83%	17%	<i>Gracilariopsis lemaneiformis</i>	9.58	-	yes / -
						<i>Gracilaria conferta</i>	9.50	-	yes / -
						<i>Gracilaria pacifica</i>	9.43	-	yes / -
						<i>Gracilaria gaditana</i>	9.40	-	yes / -
						<i>Gracilaria</i> sp. 3	9.06	-17.22	yes / yes
						<i>Curdia angustata</i>	8.81	-32.88	no / no
Halymeniaceae	yes	9.14	7	57%	43%	<i>Prionitis sternbergii</i>	9.55	-	yes / -
						<i>Prionitis lanceolata</i>	9.46	-	yes / -
						<i>Halymenia schizymenioides</i>	9.38	-	yes / -
						<i>Halymenia gardneri</i>	9.35	-	yes / -
						<i>Polyopes constrictus</i>	8.96	-	no / -
						<i>Halymenia</i> sp. 2	8.94	-35.16	no / no
						<i>Thamnoclonium dichotomum</i>	8.79	-30.13	no / no

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						<i>Carpopeltis phyllophora</i>	8.49	-	no/ -
Kallymeniaceae	no	8.81	4	0%	100%	<i>Euthora cristata</i>	8.92	-	no/ -
						<i>Callophyllis rangiferina</i>	8.82	-33.80	no / no
						<i>Kallymenia cribrosa</i>	8.81	-	no/ -
						<i>Callophyllis lambertii</i>	8.71	-33.64	no / no
Liagoraceae	yes	9.77	1	-	-	<i>Cumagloia andersonii</i> †	9.77	-16.23	yes / yes
Lomentariaceae	no	8.98	1	-	-	<i>Lomentaria articulata</i>	8.98	-29.32*	no / no
Palmariaceae	yes	10.32	3	100%	0%	<i>Palmaria decipiens</i>	10.61	-17.56	yes / yes
						<i>Halosaccion glandiforme</i> †	10.47	-14.95	yes / yes
						<i>Palmaria palmata</i> †	9.87	-18.52	yes / yes
Peyssonneliaceae	yes	8.88	1	-	-	<i>Sonderopelta coriacea</i>	8.88	-18.32	no / yes
Phacelocarpaceae	no	8.82	1	-	-	<i>Phacelocarpus peperocarpos</i>	8.82	-33.21	no / no
Phyllophoraceae	yes	9.84	5	100%	0%	<i>Mastocarpus papillatus</i>	10.34	-	yes
						<i>Mastocarpus alaskensis</i> †	9.95	-14.11	yes / yes
						<i>Mastocarpus stellatus</i>	9.90	-19.13	yes / yes
						<i>Ahnfeltiopsis leptophylla</i>	9.56	-	yes / -
						<i>Mastocarpus jardiini</i> †	9.46	-16.95	yes / yes
Plocamiaceae	no	8.69	3	0%	100%	<i>Plocamium cartilagineum</i>	8.87	-32.94	no / no
						<i>Plocamium dilatatum</i>	8.64	-33.50	no / no
						<i>Plocamium sp. 1</i>	8.56	-32.50	no / no
Rhodomelaceae	yes	9.52	10	100%	0%	<i>Neorhodomela oregona</i>	10.19	-	yes / -
						<i>Neorhodomela larix</i> †	9.99	-20.58	yes / yes
						<i>Odonthalia floccosa</i> †	9.80	-	yes / -
						<i>Polysiphonia lanosa</i>	9.77	-20.70	yes / yes
						<i>Osmundea pinnatifida</i>	9.73	-15.61	yes / yes
						<i>Polysiphonia hendryi gardneri</i>	9.54	-	yes / -
						<i>Osmundea spectabilis</i> †	9.48	-16.31	yes / yes

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						<i>Odonthalia washingtoniensis</i>	9.24	-	yes / -
						<i>Lenormandia marginata</i>	9.01	-23.25	no / yes
						<i>Laurencia</i> sp. 2	8.40	-11.00	no / yes
Rhodymeniaceae	no	8.71	2	0%	100%	<i>Sparlingia pertusa</i>	8.97	-	no / -
						<i>Rhodymenia</i> sp. 2	8.69	-33.27	no / no
						<i>Gloiosaccion brownii</i>	8.48	-33.99	no / no
Schizymeniaceae	yes	9.02	1	-	-	<i>Schizymenia pacifica</i>	9.02	-18.46	no / yes
Solieriaceae	yes	9.23	2	100%	0%	<i>Sarcodiotheca gaudichaudii</i>	9.32	-	yes / -
						<i>Sarcodiotheca furcata</i>	9.13	-	yes / -