Supplement 1

Table S1: Additional guidelines for conducting reliable and reproducible coralline algal species identifications

Method	Notes	Key References
Molecular Identification		
Collecting for DNA sequencing	**Collection:** Be sure that the sample represents a single species as it is common for margins between corallines to blur and species overgrowth to occur. Only a small subsample (~1x1cm) is needed for DNA extraction. **Cleaning:** Carefully remove epiphytes and check for endophytes to reduce chances of contamination for DNA extraction. Although markers used are often designed for coralline algae, they can often amplify other species. **Preservation:** The best way to preserve specimens for DNA extraction is through rapid desiccation. This is usually achieved through the use of silica gel. Wrap the coralline in tissue or thin cloth before placing in silica gel to avoid losing crumbs as the sample becomes brittle on drying. Store specimen in container or sealable bag with silica gel in a dry, cool place out of the light until ready for DNA extraction.	Collection and storage protocols (see Harvey et al. 2005 pg 24-29; Farr et al. 2009 pg 20-22)
Marker selection	The three commonly used markers in coralline algae research are: *psb*A (photosystem II D1 protein)- 852bp length. *rbc*L (ribulose-1,5-bisphosphate carboxylase/oxygenase large subunit) - 1467bp length. Typically amplified in two parts. Note that often smaller segments of *rbc*L ~200bp in length are usually used for old specimens with degraded DNA COI-5P (cytochrome oxidase subunit 1)- 664bp length	Commonly used *psb*A primers - *psb*A-F1 in combination with *psb*A-R2 or *psb*A-R1 (Yoon et al. 2002). Commonly used *rbc*L primers - Many different primer combinations (see Freshwater & Rueness 1994; Gabrielson et al. 2011; Hughey & Gabrielson 2012; Hernandez-Kantun et al. 2016; Twist et al. 2019) Commonly used COI-5P primers - Many different primer combinations (see Le Gall & Saunders 2010; Clarkston & Saunders 2012; Saunders & Moore, 2013)

DNA extractions	Many different commercially available DNA extraction kits have been used successfully for coralline algae. These include but are not limited to; Qiangen DNeasy kits, GenElute DNA kits, QuickExtract and NucleoSpin tissue kit	Extractions protocols for coralline algae (see e.g. Hughey et al. 2001; Broom et al. 2008; Gabrielson et al. 2011; Rösler et al. 2016; Anglès d'Auriac et al. 2019; Pezzolesi et al. 2019; Twist et al. 2019)
PCR amplifications	PCR reagents can be sourced from a number of commercial vendors. Protocols for PCR amplifications are dependent on the marker being used, often with different annealing temperatures and times.	*psb*A - (e.g. Broom et al. 2008; Richards et al 2014; Adey et al. 2015a; Twist et al. 2019) *rbc*L - (e.g. Adey et al. 2015a; Hernandez-Kantun et al. 2016; Twist et al. 2019) COI-5P - (e.g. Richards et al 2014; Peña et al. 2015)
Sequencing	Various commercial agencies exist for Sanger sequencing of amplified PCR products.	A search of Sanger sequencing will reveal several agencies where PCR products can be sent to.
Species Identification		
Sequence trimming and cleaning	Often sequences need to be assessed for quality and the ends trimmed before these are compared to other sequences in an online database. There are various programs designed for this (e.g. Geneious, MEGA, BioEdit, ClustalW2).	Additional information on sequence editing can be found in MacManes 2014
GenBank (sequence databases)	GenBank and other sequence databases (e.g. BOLD) are good places to compare sequence data. However, the names applied to sequences in these databases are sometimes out of date and/or unreliable.	GenBank entries can be searched using a BLAST query of a nucleotide sequence (https://blast.ncbi.nlm.nih.gov/)
Taxonomy and Taxonomic guidelines	Algaebase is a great starting point for up to date taxonomy on coralline algae research.	https://www.algaebase.org/
Morpho-anatomical identification	Due to coralline algae taxonomy rapidly changing, published	Primary literature and Algaebase

(***Not recommended***)	identification guides often include outdated information on taxonomic names therefore should be used with extreme caution. Recent taxonomic primary literature can be consulted for updated species descriptions and defining characteristics (although often there are very few defining characters for newly described coralline species). Additionally, Algaebase can be a great resource for the status of currently accepted names and also provides links to key references.	
Voucher specimen storage	Depositing voucher specimens in a recognized herbarium can be done at relatively low cost and provides a long-term record long after an article has been published. These vouchers can therefore be compared and re-examined many years later.	A list of globally registered herbarium can be found at http://sweetgum.nybg.org/science/ih/ A detailed outline of best practices for herbarium care of coralline algae can be found in Appendix 1 of Nelson et al. 2019

References used in the Key References column of Table S1

Adey WH, Hernandez-Kantun JJ, Johnson G, Gabrielson PW (2015a) DNA sequencing, anatomy, and calcification patterns support a monophyletic, subarctic, carbonate reef-forming *Clathromorphum* (Hapalidiaceae, Corallinales, Rhodophyta). J Phycol 51:189–203 PubMed doi:10.1111/jpy.12266

Anglès d'Auriac MBA, Le Gall L, Peña V, Hall-Spencer JM and others (2019) Efficient coralline algal *psb*A mini barcoding and High Resolution Melt (HRM) analysis using a simple custom DNA preparation. Sci Rep 9:578 PubMed doi:10.1038/s41598-018-37186-2

Broom JE, Hart DR, Farr TJ, Nelson WA, Neill KF, Harvey AS, Woelkerling WJ (2008) Utility of *psb*A and nSSU for phylogenetic reconstruction in the Corallinales based on New Zealand taxa. Mol Phylogenet Evol 46:958–973 PubMed doi:10.1016/j.ympev.2007.12.016

Clarkston BE, Saunders GW (2012) An examination of the red algal genus *Pugetia* (Kallymeniaceae, Gigartinales), with descriptions of *Salishia firma* gen. & comb. nov., *Pugetia cryptica* sp. nov. and *Beringia wynnei* sp. nov. Phycologia 51:33–61 doi:10.2216/11-01.1

Farr, T. J., Broom, J., Hart, D. R., Neill, K., & Nelson, W. A. (2009). Common coralline algae of northern New Zealand: an identification guide. *NIWA information series, 70*, 1-125.

Freshwater DW, Rueness J (1994) Phylogenetic relationships of some European *Gelidium* (Gelidiales, Rhodophyta) species, based on *rbc*L nucleotide sequence analysis. Phycologia 33:187–194 doi:10.2216/i0031-8884-33-3-187.1

Gabrielson PW, Miller KA, Martone PT (2011) Morphometric and molecular analyses confirm two distinct species of *Calliarthron* (Corallinales, Rhodophyta), a genus endemic to the northeast Pacific. Phycologia 50:298–316 doi:10.2216/10-42.1

Harvey, A., Woelkerling, W., Farr, T. J., Neill, K., & Nelson W. A., (2005). Coralline algae of central New Zealand: an identification guide to common 'crustose' species. *NIWA information series, 57*, 1-145.

Hernandez-Kantun JJ, Gabrielson P, Hughey JR, Pezzolesi L and others (2016) Reassessment of branched *Lithophyllum* spp.(Corallinales, Rhodophyta) in the Caribbean Sea with global implications. Phycologia 55:619–639 doi:10.2216/16-7.1

Hughey JR, Gabrielson PW (2012) Comment on "Acquiring DNA sequence data from dried archival red algae (Florideophyceae) for the purpose of applying available names to contemporary genetic species: a critical assessment". Botany 90:1191–1194 doi:10.1139/b2012-102

Hughey JR, Silva PC, Hommersand MH (2001) Solving taxonomic and nomenclatural problems in Pacific Gigartinaceae (Rhodophyta) using DNA from type material. J Phycol 37:1091–1109 doi:10.1046/j.1529-8817.2001.01048.x

Le Gall L, Saunders GW (2010) Dna barcoding is a powerful tool to uncover algal diversity: A case study of the Phyllophoraceae (Gigartinales, Rhodophyta) in the Canadian flora 1. J Phycol 46:374–389 doi:10.1111/j.1529-8817.2010.00807.x

Macmanes MD (2014) On the optimal trimming of high-throughput mRNA sequence data. Front Genet 5:13 PubMed doi:10.3389/fgene.2014.00013

Nelson WA, Twist BA, Neill KF, Sutherland JE (2019). Coralline algae of New Zealand: a summary of recent research and the current state of knowledge. *New Zealand Aquatic Environment and Biodiversity Report* No. 232

Peña V, De Clerck O, Afonso-Carrillo J, Ballesteros E, Bárbara I, Barreiro R, Le Gall L (2015) An integrative systematic approach to species diversity and distribution in the genus *Mesophyllum* (Corallinales, Rhodophyta) in Atlantic and Mediterranean Europe. Eur J Phycol 50:20–36 doi:10.1080/09670262.2014.981294

Pezzolesi L, Peña V, Le Gall L, Gabrielson PW and others (2019) Mediterranean *Lithophyllum stictiforme* (Corallinales, Rhodophyta) is a genetically diverse species complex: implications for species circumscription, biogeography and conservation of coralligenous habitats. J Phycol 55:473–492 PubMed doi:10.1111/jpy.12837

Richards JL, Gabrielson PW, Fredericq S (2014) New insights into the genus *Lithophyllum* (Lithophylloideae, Corallinaceae, Corallinales) from deepwater rhodolith beds offshore the NW Gulf of Mexico. Phytotaxa 190:162–175 doi:10.11646/phytotaxa.190.1.11

Rösler A, Perfectti F, Peña V, Braga JC (2016) Phylogenetic relationships of corallinaceae (Corallinales, Rhodophyta): taxonomic implications for reef□building corallines. J Phycol 52:412–431 PubMed doi:10.1111/jpy.12404

Saunders GW, Moore TE (2013) Refinements for the amplification and sequencing of red algal DNA barcode and RedToL phylogenetic markers: a summary of current primers, profiles and strategies. Algae 28:31–43 doi:10.4490/algae.2013.28.1.031

Twist BA, Neill KF, Bilewitch J, Jeong SY, Sutherland JE, Nelson WA (2019) High diversity of coralline algae in New Zealand revealed: Knowledge gaps and implications for future research. PLoS One 14:e0225645 PubMed doi:10.1371/journal.pone.0225645

Yoon HS, Hackett JD, Bhattacharya D (2002) A single origin of the peridinin-and fucoxanthin-containing plastids in dinoflagellates through tertiary endosymbiosis. Proc Natl Acad Sci USA 99:11724–11729 PubMed doi:10.1073/pnas.172234799

Supplement 2: List of studies selected for analysis in this manuscript

Adey W, Halfar J, Humphreys A, Suskiewicz T, Belanger D, Gagnon P, Fox M (2015b) Subarctic rhodolith beds promote longevity of crustose coralline algal buildups and their climate archiving potential. Palaios 30:281–293 doi:10.2110/palo.2014.075

Aguado-Giménez F, Ruiz-Fernández JM (2012) Influence of an experimental fish farm on the spatio-temporal dynamic of a Mediterranean maërl algae community. Mar Environ Res 74:47–55 PubMed doi:10.1016/j.marenvres.2011.12.003

Alestra T, Schiel DR (2015) Non-trophic responses of algal communities to nutrient enrichment: interactions among coralline turfs, ephemeral algae and perennial fucoids. Mar Ecol Prog Ser 538:145–156 doi:10.3354/meps11462

Amado-Filho GM, Moura RL, Bastos AC, Salgado LT and others (2012a) Rhodolith Beds Are Major CaCO3 Bio-Factories in the Tropical South West Atlantic. PLoS One 7: e35171 PubMed

Amado-Filho GM, Pereira GH, Bahia RG, Abrantes DP, Veras PC, Matheus Z (2012b) Occurrence and distribution of rhodolith beds on the Fernando de Noronha Archipelago of Brazil. Aquat Bot 101:41–45 doi:10.1016/j.aquabot.2012.03.016

Amado-Filho GM, Maneveldt GW, Pereira-Filho GH, Manso RCC, Bahia RG, Barros-Barreto MB, Guimarães SMPB (2010) Seaweed diversity associated with a Brazilian tropical rhodolith bed. Cienc Mar 36:371–391 doi:10.7773/cm.v36i4.1782

Amado-Filho GM, Moura RL, Bastos AC, Francini-Filho RB and others (2016) Mesophotic ecosystems of the unique South Atlantic atoll are composed by rhodolith beds and scattered consolidated reefs. Mar Biodivers 46:933–936 doi:10.1007/s12526-015-0441-6

Anagnostou E, Williams B, Westfield I, Foster GL, Ries JB (2019) Calibration of the pH-11B and temperature-Mg/Li proxies in the long-lived high-latitude crustose coralline red alga *Clathromorphum compactum* via controlled laboratory experiments. Geochim Cosmochim Acta 254:142–155 doi:10.1016/j.gca.2019.03.015

Arnold SN, Steneck RS (2011) Settling into an increasingly hostile world: the rapidly closing "recruitment window" for corals. PLoS One 6:e28681 PubMed doi:10.1371/journal.pone.0028681

Arnold SN, Steneck RS, Mumby PJ (2010) Running the gauntlet: inhibitory effects of algal turfs on the processes of coral recruitment. Mar Ecol Prog Ser 414:91–105 doi:10.3354/meps08724

Asnaghi V, Chiantore M, Mangialajo L, Gazeau F, Francour P, Alliouane S, Gattuso JP (2013) Cascading effects of ocean acidification in a rocky subtidal community. PLoS One 8:e61978 PubMed doi:10.1371/journal.pone.0061978

Asnaghi V, Mangialajo L, Gattuso JP, Francour P, Privitera D, Chiantore M (2014) Effects of ocean acidification and diet on thickness and carbonate elemental composition of the test of juvenile sea urchins. Mar Environ Res 93:78–84 PubMed doi:10.1016/j.marenvres.2013.08.005

Asnaghi V, Thrush SF, Hewitt JE, Mangialajo L, Cattaneo-Vietti R, Chiantore M (2015) Colonisation processes and the role of coralline algae in rocky shore community dynamics. J Sea Res 95:132–138 doi:10.1016/j.seares.2014.07.012

Attard KM, Stahl H, Kamenos N, Turner G, Burdett HL, Glud RN (2015) Benthic oxygen exchange in a live coralline algal bed and an adjacent sandy habitat: an eddy covariance study. Mar Ecol Prog Ser 535:99–115 doi:10.3354/meps11413

Ávila E, Riosmena-Rodriguez R (2011) A preliminary evaluation of shallow-water rhodolith beds in Bahia Magdalena, Mexico. Braz J Oceanogr 59:365–375 doi:10.1590/S1679-87592011000400007

Bach LL, Freer JJ, Kamenos NA (2017) In situ response of tropical coralline algae to a novel thermal regime. Front Mar Sci 4:8 doi:10.3389/fmars.2017.00212

Bahia RG, Abrantes DP, Brasileiro PS, Pereira Filho GH, Amado Filho GM (2010) Rhodolith bed structure along a depth gradient on the northern coast of Bahia state, Brazil. Braz J Oceanogr 58:323–337 doi:10.1590/S1679-87592010000400007

Barberá C, Mallol S, Vergés A, Cabanellas-Reboredo M, Díaz D, Goñi R (2017) Maerl beds inside and outside a 25-year-old no-take area. Mar Ecol Prog Ser 572:77–90. doi:10.3354/meps12110 doi:10.3354/meps12110

Barner AK, Chan F, Hettinger A, Hacker SD, Marshall K, Menge BA (2018) Generality in multispecies responses to ocean acidification revealed through multiple hypothesis testing. Glob Change Biol 24:4464–4477 PubMed doi:10.1111/gcb.14372

Benzoni F, Basso D, Caragnano A, Rodondi G (2011) *Hydrolithon* spp.(Rhodophyta, Corallinales) overgrow live corals (Cnidaria, Scleractinia) in Yemen. Mar Biol 158:2419–2428 doi:10.1007/s00227-011-1743-2

Berlandi RM, Figueiredo MAO, Paiva PC (2012) Rhodolith morphology and the diversity of polychaetes off the southeastern Brazilian coast. J Coast Res 28:280–287 doi:10.2112/11T-00002.1

Bertocci I, Araujo R, Incera M, Arenas F and others (2012) Benthic assemblages of rock pools in northern Portugal: seasonal and between-pool variability. Sci Mar 76:781–789

Bessell-Browne P, Negri AP, Fisher R, Clode PL, Jones R (2017) Impacts of light limitation on corals and crustose coralline algae. Sci Rep 7:11553 PubMed doi:10.1038/s41598-017-11783-z

Blamey LK, Branch GM (2012) Regime shift of a kelp-forest benthic community induced by an 'invasion' of the rock lobster *Jasus lalandii.* J Exp Mar Biol Ecol 420-421:33–47 doi:10.1016/j.jembe.2012.03.022

Bonaviri C, Fernández TV, Fanelli G, Badalamenti F, Gianguzza P (2011) Leading role of the sea urchin *Arbacia lixula* in maintaining the barren state in southwestern Mediterranean. Mar Biol 158:2505–2513 doi:10.1007/s00227-011-1751-2

Bradassi F, Cumani F, Bressan G, Dupont S (2013) Early reproductive stages in the crustose coralline alga *Phymatolithon lenormandii* are strongly affected by mild ocean acidification. Mar Biol 160:2261–2269 doi:10.1007/s00227-013-2260-2

Brasileiro PS, Pereira-Filho GH, Bahia RG, Abrantes DP and others (2016) Macroalgal composition and community structure of the largest rhodolith beds in the world. Mar Biodivers 46:407–420 doi:10.1007/s12526-015-0378-9

Brett CE, Parsons-Hubbard KM, Walker SE, Ferguson C and others (2011) Gradients and patterns of sclerobionts on experimentally deployed bivalve shells: synopsis of bathymetric and temporal trends on a decadal time scale. Palaeogeogr Palaeoclimatol Palaeoecol 312:278–304 doi:10.1016/j.palaeo.2011.05.019

Briggs AA, Carpenter RC (2019) Contrasting responses of photosynthesis and photochemical efficiency to ocean acidification under different light environments in a calcifying alga. Sci Rep 9:3986 PubMed doi:10.1038/s41598-019-40620-8

Brodie J, Williamson C, Barker GL, Walker RH, Briscoe A, Yallop M (2016) Characterising the microbiome of *Corallina officinalis*, a dominant calcified intertidal red alga. FEMS Microbiol Ecol 92:fiw110 PubMed doi:10.1093/femsec/fiw110

Browne CM, Milne R, Griffiths C, Bolton JJ, Anderson RJ (2013) Epiphytic seaweeds and invertebrates associated with South African populations of the rocky shore seagrass *Thalassodendron leptocaule*—a hidden wealth of biodiversity. Afr J Mar Sci 35:523–531 doi:10.2989/1814232X.2013.864332

Büdenbender J, Riebesell U, Form A (2011) Calcification of the Arctic coralline red algae *Lithothamnion glaciale* in response to elevated CO2. Mar Ecol Prog Ser 441:79–87 doi:10.3354/meps09405

Bueno M, Dias GM, Leite FPP (2017) The importance of shore height and host identity for amphipod assemblages. Mar Biol Res 13:870–877 doi:10.1080/17451000.2017.1306650

Bueno M, Flores AAV, Leite FPP (2019) Seasonal dynamics of amphipod assemblages in intertidal coralline algal mats on two Brazilian shores. Bull Mar Sci 95:83–100 doi:10.5343/bms.2018.0028

Burdett HL (2017) Exchange Dynamics Reveal Significant Accumulation of Dimethylated Sulfur by Mediterranean Benthic Communities. Front Mar Sci 4:9 doi:10.3389/fmars.2017.00431

Burdett HL, Aloisio E, Calosi P, Findlay HS, Widdicombe S, Hatton AD, Kamenos NA (2012a) The effect of chronic and acute low pH on the intracellular DMSP production and epithelial cell morphology of red coralline algae. Mar Biol Res 8:756–763 doi:10.1080/17451000.2012.676189

Burdett HL, Hennige SJ, Francis FTY, Kamenos NA (2012b) The photosynthetic characteristics of red coralline algae, determined using pulse amplitude modulation (PAM) fluorometry. Bot Mar 55:499–509 doi:10.1515/bot-2012-0135

Burdett HL, Keddie V, MacArthur N, McDowall L and others (2014) Dynamic photoinhibition exhibited by red coralline algae in the red sea. BMC Plant Biol 14:139 PubMed doi:10.1186/1471-2229-14-139

Burdett HL, Hatton AD, Kamenos NA (2015) Coralline algae as a globally significant pool of marine dimethylated sulfur. Global Biogeochem Cycles 29:1845–1853 doi:10.1002/2015GB005274

Cabanellas-Reboredo M, Mallol S, Barberá C, Vergés A, Díaz D, Goñi R (2018) Morpho-demographic traits of two maërl-forming algae in beds with different depths and fishing histories. Aquat Conserv 28:133–145 doi:10.1002/aqc.2827

Caragnano A, Basso D, Jacob DE, Storz D, Rodondi G, Benzoni F, Dutrieux E (2014) The coralline red alga *Lithophyllum kotschyanum* f. *affine* as proxy of climate variability in the Yemen coast, Gulf of Aden (NW Indian Ocean). Geochim Cosmochim Acta 124:1–17 doi:10.1016/j.gca.2013.09.021

Caragnano A, Basso D, Rodondi G (2016) Growth rates and ecology of coralline rhodoliths from the Ras Ghamila back reef lagoon, Red Sea. PSZNI: Mar Ecol 37:713–726 doi:10.1111/maec.12371

Catra M, Alongi G, Leonardi R, Negri MP and others (2019) Degradation of a photophilic algal community and its associated fauna from eastern Sicily (Mediterranean Sea). Mediterr Mar Sci 20:74–89

Cavalcanti GS, Shukla P, Morris M, Ribeiro B and others (2018) Rhodoliths holobionts in a changing ocean: host-microbes interactions mediate coralline algae resilience under ocean acidification. BMC Genomics 19:701 PubMed doi:10.1186/s12864-018-5064-4

Chan P, Halfar J, Adey W, Hetzinger S and others (2017a) Multicentennial record of Labrador Sea primary productivity and sea-ice variability archived in coralline algal barium. Nat Commun 8:15543 PubMed doi:10.1038/s41467-017-00017-5

Chan P, Halfar J, Norley CJD, Pollmann SI, Adey W, Holdsworth DW (2017b) Micro-computed tomography: Applications for high-resolution skeletal density determinations: An example using annually banded crustose coralline algae. Geochem Geophys Geosyst 18:3542–3553 doi:10.1002/2017GC006966

Comeau S, Carpenter RC, Edmunds PJ (2012) Coral reef calcifiers buffer their response to ocean acidification using both bicarbonate and carbonate. Proc Biol Sci 280:20122374 PubMed

Comeau S, Lantz CA, Edmunds PJ, Carpenter RC (2016) Framework of barrier reefs threatened by ocean acidification. Glob Change Biol 22:1225–1234 PubMed doi:10.1111/gcb.13023

Comeau S, Cornwall CE, DeCarlo TM, Krieger E, McCulloch MT (2018) Similar controls on calcification under ocean acidification across unrelated coral reef taxa. Glob Change Biol 24:4857–4868 PubMed doi:10.1111/gcb.14379

Comeau S, Cornwall CE, Pupier CA, DeCarlo TM, Alessi C, Trehern R, McCullough MT (2019a) Flow-driven micro-scale pH variability affects the physiology of corals and coralline algae under ocean acidification. Sci Rep 9:12829 PubMed doi:10.1038/s41598-019-49044-w

Comeau S, Cornwall CE, DeCarlo TM, Doo SS, Carpenter RC, McCulloch MT (2019b) Resistance to ocean acidification in coral reef taxa is not gained by acclimatization. Nat Clim Chang 9:477–483 doi:10.1038/s41558-019-0486-9

Cornwall CE, Hepburn CD, McGraw CM, Currie KI and others (2013a) Diurnal fluctuations in seawater pH influence the response of a calcifying macroalga to ocean acidification. Proc Biol Sci 280:20132201 PubMed

Cornwall CE, Hepburn CD, Pilditch CA, Hurd CL (2013b) Concentration boundary layers around complex assemblages of macroalgae: Implications for the effects of ocean acidification on understory coralline algae. Limnol Oceanogr 58:121–130 doi:10.4319/lo.2013.58.1.0121

Cornwall CE, Boyd PW, McGraw CM, Hepburn CD and others (2014) Diffusion Boundary Layers Ameliorate the Negative Effects of Ocean Acidification on the Temperate Coralline Macroalga *Arthrocardia corymbosa.* PLoS One 9:e97235 PubMed doi:10.1371/journal.pone.0097235

Cornwall CE, Pilditch CA, Hepburn CD, Hurd CL (2015) Canopy macroalgae influence understorey corallines' metabolic control of near-surface pH and oxygen concentration. Mar Ecol Prog Ser 525:81–95 doi:10.3354/meps11190

Cornwall CE, Comeau S, McCulloch MT (2017) Coralline algae elevate pH at the site of calcification under ocean acidification. Glob Change Biol 23:4245–4256 PubMed doi:10.1111/gcb.13673

Cornwall CE, Comeau S, DeCarlo TM, Moore B, D'alexis Q, McCulloch MT (2018) Resistance of corals and coralline algae to ocean acidification: physiological control of calcification under natural pH variability. Proc Biol Sci 285:20181168 PubMed

Costa IO, Horta PA, Bergstrom ER, Nunes JMC (2014) Taxonomic study of crustose coralline algae off the northeastern Brazilian coast. Phytotaxa 190:130–161 doi:10.11646/phytotaxa.190.1.10

Couto RP, Neto AI, Rodrigues AS (2010) Metal concentration and structural changes in *Corallina elongata* (Corallinales, Rhodophyta) from hydrothermal vents. Mar Pollut Bull 60:509–514 PubMed doi:10.1016/j.marpolbul.2009.11.014

Cusack M, Kamenos NA, Rollion-Bard C, Tricot G (2015) Red coralline algae assessed as marine pH proxies using 11B MAS NMR. Sci Rep 5:8175 PubMed doi:10.1038/srep08175

Darrenougue N, De Deckker P, Payri C, Eggins S, Fallon S (2013) Growth and chronology of the rhodolith-forming, coralline red alga Sporolithon durum. Mar Ecol Prog Ser 474:105–119 doi:10.3354/meps10085

Darrenougue N, De Deckker P, Eggins S, Payri C (2014) Sea-surface temperature reconstruction from trace elements variations of tropical coralline red algae. Quat Sci Rev 93:34–46 doi:10.1016/j.quascirev.2014.03.005

Davies SW, Meyer E, Guermond SM, Matz MV (2014) A cross-ocean comparison of responses to settlement cues in reef-building corals. PeerJ 2:e333 PubMed doi:10.7717/peerj.333

Davis AR, Becerro M, Turon X (2018) Living on the edge: Early life history phases as determinants of distribution in Pyura praeputialis (Heller, 1878), a rocky shore ecosystem engineer. Mar Environ Res 142:40–47 PubMed doi:10.1016/j.marenvres.2018.09.019

de Carvalho RT, Salgado LT, Amado GM, Leal RN and others (2017) Biomineralization of calcium carbonate in the cell wall of *Lithothamnion crispatum* (Hapalidiales, Rhodophyta): correlation between the organic matrix and the mineral phase. J Phycol 53:642–651 PubMed doi:10.1111/jpy.12526

De Jode A, David R, Haguenauer A, Cahill AE and others (2019) From seascape ecology to population genomics and back. Spatial and ecological differentiation among cryptic species of the red algae *Lithophyllum stictiforme/L. cabiochiae*, main bioconstructors of coralligenous habitats. Mol Phylogenet Evol 137:104–113 PubMed doi:10.1016/j.ympev.2019.04.005

Dean AJ, Steneck RS, Tager D, Pandolfi JM (2015) Distribution, abundance and diversity of crustose coralline algae on the Great Barrier Reef. Coral Reefs 34:581–594 doi:10.1007/s00338-015-1263-5

DeCarlo TM, Comeau S, Cornwall CE, Gajdzik L and others (2019) Investigating marine bio-calcification mechanisms in a changing ocean with in vivo and high-resolution ex vivo Raman spectroscopy. Glob Change Biol 25:1877–1888 PubMed doi:10.1111/gcb.14579

Denis V, Loubeyres M, Doo SS, de Palmas S, Keshavmurthy S, Hsieh HJ, Chen CA (2014) Can benthic algae mediate larval behavior and settlement of the coral *Acropora muricata?* Coral Reefs 33:431–440

Denny MW, King FA (2016) The extraordinary joint material of an articulated coralline alga. I. Mechanical characterization of a key adaptation. J Exp Biol 219:1833–1842 PubMed doi:10.1242/jeb.138859

Denny M, Mach K, Tepler S, Martone P (2013) Indefatigable: an erect coralline alga is highly resistant to fatigue. J Exp Biol 216:3772–3780 PubMed doi:10.1242/jeb.091264

Deter J, Descamp P, Boissery P, Ballesta L, Holon F (2012) A rapid photographic method detects depth gradient in coralligenous assemblages. J Exp Mar Biol Ecol 418-419:75–82 doi:10.1016/j.jembe.2012.03.006

Diaz-Pulido G, Anthony KRN, Kline DI, Dove S, Hoegh-Guldberg O (2012) Interactions between ocean acidification and warming on the mortality and dissolution of coralline algae. J Phycol 48:32–39 PubMed doi:10.1111/j.1529-8817.2011.01084.x

Diaz-Pulido G, Nash MC, Anthony KRN, Bender D, Opdyke BN, Reves-Nivia C, Troitzsch U (2014) Greenhouse conditions induce mineralogical changes and dolomite accumulation in coralline algae on tropical reefs. Nat Commun 5: 3310 PubMed doi:10.1038/ncomms4310

Diez I, Muguerza N, Santolaria A, Ganzedo U, Gorostiaga JM (2012) Seaweed assemblage changes in the eastern Cantabrian Sea and their potential relationship to climate change. Estuar Coast Shelf Sci 99:108–120 doi:10.1016/j.ecss.2011.12.027

Donald HK, Ries JB, Stewart JA, Fowell SE, Foster GL (2017) Boron isotope sensitivity to seawater pH change in a species of *Neogoniolithon* coralline red alga. Geochim Cosmochim Acta 217:240–253 doi:10.1016/j.gca.2017.08.021

Donnarumma L, Lombardi C, Cocito S, Gambi MC (2014) Settlement pattern of *Posidonia oceanica* epibionts along a gradient of ocean acidification: an approach with mimics. Mediterr Mar Sci 15:498–509 doi:10.12681/mms.677

Doropoulos C, Diaz-Pulido G (2013) High CO_2 reduces the settlement of a spawning coral on three common species of crustose coralline algae. Mar Ecol Prog Ser 475:93–99 doi:10.3354/meps10096

Doropoulos C, Ward S, Diaz-Pulido G, Hoegh-Guldberg O, Mumby PJ (2012) Ocean acidification reduces coral recruitment by disrupting intimate larval-algal settlement interactions. Ecol Lett 15:338–346 PubMed doi:10.1111/j.1461-0248.2012.01743.x

Doropoulos C, Gómez-Lemos LA, Babcock RC (2018) Exploring variable patterns of density-dependent larval settlement among corals with distinct and shared functional traits. Coral Reefs 37:25–29 doi:10.1007/s00338-017-1629-y

Egilsdottir H, Noisette F, Laure MLN, Olafsson J, Martin S (2013) Effects of pCO 2 on physiology and skeletal mineralogy in a tidal pool coralline alga *Corallina elongata.* Mar Biol 160:2103–2112 doi:10.1007/s00227-012-2090-7

Egilsdottir H, Olafsson J, Martin S (2016) Photosynthesis and calcification in the articulated coralline alga *Ellisolandia elongata* (Corallinales, Rhodophyta) from intertidal rock pools. Eur J Phycol 51:59–70 doi:10.1080/09670262.2015.1101165

Elliott SAM, Turrell WR, Heath MR, Bailey DM (2017) Juvenile gadoid habitat and ontogenetic shift observations using stereo-video baited cameras. Mar Ecol Prog Ser 568:123–135 doi:10.3354/meps12068

Fabricius KE, Kluibenschedl A, Harrington L, Noonan S, De'ath G (2015) In situ changes of tropical crustose coralline algae along carbon dioxide gradients. Sci Rep 5: 9537 PubMed doi:10.1038/srep09537

Fabricius KE, Noonan SHC, Abrego D, Harrington L, De'ath G (2017). Low recruitment due to altered settlement substrata as primary constraint for coral communities under ocean acidification. Proc Biol Sci, 284(1862), 9.

Fernández C (2016) Current status and multidecadal biogeographical changes in rocky intertidal algal assemblages: the northern Spanish coast. Estuar Coast Shelf Sci 171:35–40 doi:10.1016/j.ecss.2016.01.026

Fietzke J, Ragazzola F, Halfar J, Dietze H and others (2015) Century-scale trends and seasonality in pH and temperature for shallow zones of the Bering Sea. Proc Natl Acad Sci USA 112:2960–2965 PubMed doi:10.1073/pnas.1419216112

Figueiredo MAO, Coutinho R, Villas-Boas AB, Tamega FTS, Mariath R (2012) Deep-water rhodolith productivity and growth in the southwestern Atlantic. J Appl Phycol 24:487–493 doi:10.1007/s10811-012-9802-8

Figueiredo MAO, Eide I, Reynier M, Villas-Boas AB and others (2015) The effect of sediment mimicking drill cuttings on deep water rhodoliths in a flow-through system: Experimental work and modeling. Mar Pollut Bull 95:81–88 PubMed doi:10.1016/j.marpolbul.2015.04.040

Figueroa FL, Hermoso-Beltrán M, Celis-Plá PS, Bonomi-Barufi J and others (2016) Photosynthetic activity estimated as in vivo chlorophyll a fluorescence in calcareous red macroalgae. Cienc Mar 42:139–155 doi:10.7773/cm.v42i2.2587

Fine M, Tsadok R, Meron D, Cohen S, Milazzo M (2017) Environmental sensitivity of *Neogoniolithon brassica-florida* associated with vermetid reefs in the Mediterranean Sea. ICES J Mar Sci 74:1074–1082 doi:10.1093/icesjms/fsw167

Fisher K, Martone PT (2014) Field study of growth and calcification rates of three species of articulated coralline Algae in British Columbia, Canada. Biol Bull 226:121–130 PubMed doi:10.1086/BBLv226n2p121

Fredriksen S, Gabrielson TM, Kile MR, Siversten K (2015) Benthic algal vegetation in Isfjorden, Svalbard. Polar Res 34:25994 doi:10.3402/polar.v34.25994

Freire VP, Rousseau F, De Reviers B, Le Gall L (2014) First assessment of the diversity of coralline species forming maerl and rhodoliths in Guadeloupe, Caribbean using an integrative systematic approach. Phytotaxa 190:190–215 doi:10.11646/phytotaxa.190.1.13

Freitas C, Araújo R, Bertocci I (2016) Patterns of benthic assemblages invaded and non-invaded by *Grateloupia turuturu* across rocky intertidal habitats. J Sea Res 115:26–32 doi:10.1016/j.seares.2016.07.002

Gagnon P, Matheson K, Stapleton M (2012) Variation in rhodolith morphology and biogenic potential of newly discovered rhodolith beds in Newfoundland and Labrador (Canada). Bot Mar 55:85–99 doi:10.1515/bot-2011-0064

Gamboa G, Halfar J, Hetzinger S, Adey W, Zack T, Kunz B, Jacob DE (2010) Mg/Ca ratios in coralline algae record northwest Atlantic temperature variations and North Atlantic Oscillation relationships. J Geophys Res 115:C12044 doi:10.1029/2010JC006262

Gao K, Zheng Y (2010) Combined effects of ocean acidification and solar UV radiation on photosynthesis, growth, pigmentation and calcification of the coralline alga *Corallina sessilis* (Rhodophyta). Glob Change Biol 16:2388–2398 doi:10.1111/j.1365-2486.2009.02113.x

Gao K, Xu J, Zheng Y, Ke C (2012) Measurement of benthic photosynthesis and calcification in flowing-through seawater with stable carbonate chemistry. Limnol Oceanogr Methods 10:555–559 doi:10.4319/lom.2012.10.555

Gao S, Sun Q, Tao Y, Wang X and others (2016) A decline in macro-algae species resulting in the overwhelming prevalence of *Corallina* species is caused by low-pH seawater induced by short-term acid rain. J Exp Mar Biol Ecol 475:144–153 doi:10.1016/j.jembe.2015.11.019

Gazeau F, Urbini L, Cox TE, Alliouane S, Gattuso JP (2015) Comparison of the alkalinity and calcium anamaly techniques to estimate rates of net calcification. Mar Ecol Prog Ser 527:1–12 doi:10.3354/meps11287

Gefen-Treves S, Kedem I, Weiss G, Wagner D, Tchernov D, Kaplan A (2020) Acclimation of a rocky shore algal reef builder *Neogoniolithon* sp. to changing illuminations. Limnol Oceanogr 65:27–36 doi:10.1002/lno.11245

Gersun L, Anderson RJ, Hart JR, Maneveldt GW, Bolton JJ (2016) Sublittoral seaweed communities on natural and artificial substrata in a high-latitude coral community in South Africa. Afr J Mar Sci 38:303–316 doi:10.2989/1814232X.2016.1196727

Gianasi BL, Hamel JF, Mercier A (2018) Morphometric and behavioural changes in the early life stages of the sea cucumber *Cucumaria frondosa.* Aquaculture 490:5–18 doi:10.1016/j.aquaculture.2018.02.017

Gomez-Lemos LA, Diaz-Pulido G (2017) Crustose coralline algae and associated microbial biofilms deter seaweed settlement on coral reefs. Coral Reefs 36:453–462 doi:10.1007/s00338-017-1549-x

Gómez-Lemos LA, Doropoulos C, Bayraktarov E, Diaz-Pulido G (2018) Coralline algal metabolites induce settlement and mediate the inductive effect of epiphytic microbes on coral larvae. Sci Rep 8:17557 PubMed doi:10.1038/s41598-018-35206-9

Gore S, Renforth P, Perkins R (2019) The potential environmental response to increasing ocean alkalinity for negative emissions. Mitig Adapt Strategies Glob Change 24:1191–1211 doi:10.1007/s11027-018-9830-z

Graba-Landry A, Hoey AS, Matley JK, Sheppard-Brennand H, Poore AG, Byrne M, Dworjanyn SA (2018) Ocean warming has greater and more consistent negative effects than ocean acidification on the growth and health of subtropical macroalgae. Mar Ecol Prog Ser 595:55–69 doi:10.3354/meps12552

Guenther RJ, Martone PT (2014) Physiological performance of intertidal coralline algae during a simulated tidal cycle. J Phycol 50:310–321 PubMed doi:10.1111/jpy.12161

Guenther R, Miklasz K, Carrington E, Martone PT (2018) Macroalgal spore dysfunction: ocean acidification delays and weakens adhesion. J Phycol 54:153–158 PubMed doi:10.1111/jpy.12614

Guy-Haim T, Silverman J, Raddatz S, Wahl M, Israel A, Rilov G (2016) The carbon turnover response to thermal stress of a dominant coralline alga on the fast warming Levant coast. Limnol Oceanogr 61:1120–1133 doi:10.1002/lno.10279

Haas AF, Nelson CE, Kelly LW, Carlson CA and others (2011) Effects of coral reef benthic primary producers on dissolved organic carbon and microbial activity. PLoS One 6:e27973 PubMed doi:10.1371/journal.pone.0027973

Harvey A, Johnson ME, Harvey R (2018) Heterozoan carbonate-enriched beach sand and coastal dunes—with particular reference to rhodoliths, Dirk Hartog Island, Shark Bay, Western Australia. Facies 64:23 doi:10.1007/s10347-018-0533-4

Hassenrück C, Hofmann LC, Bischof K, Ramette A (2015) Seagrass biofilm communities at a naturally CO2-rich vent. Environ Microbiol Rep 7:516–525 PubMed doi:10.1111/1758-2229.12282

Hayakawa J, Kawamura T, Ohashi S, Horii T, Watanabe Y (2010) Importance of epiphytic diatoms and fronds of two species of red algae as diets for juvenile Japanese turban snail *Turbo cornutus*. J Shellfish Res 29:233–240 doi:10.2983/035.029.0120

Henriques MC, Riosmena-Rodríguez R, Coutinho LM, Figueiredo MAO (2014) Lithophylloideae and Mastophoroideae (Corallinales, Rhodophyta) from the Brazilian continental shelf. Phytotaxa 190:18

Hepburn CD, Pritchard DW, Cornwall CE, McLeod RJ, Beardall J, Raven JA, Hurd CL (2011) Diversity of carbon use strategies in a kelp forest community: implications for a high CO2 ocean. Glob Change Biol 17:2488–2497 doi:10.1111/j.1365-2486.2011.02411.x

Hepburn LJ, Blanchon P, Murphy G, Cousins L, Perry CT (2015) Community structure and paleoecological implications of calcareous encrusters on artificial substrates across a Mexican Caribbean reef. Coral Reefs 34:189–200 doi:10.1007/s00338-014-1227-1

Hereu B, Kersting DK (2016) Diseases of coralline algae in the Mediterranean Sea. Coral Reefs 35:713 doi:10.1007/s00338-016-1428-x

Hetzinger S, Halfar J, Mecking JV, Keenlyside NS and others (2012) Marine proxy evidence linking decadal North Pacific and Atlantic climate. Clim Dyn 39:1447–1455 doi:10.1007/s00382-011-1229-4

Hetzinger S, Halfar J, Kronz A, Simon K, Adey WH, Steneck RS (2018) Reproducibility of *Clathromorphum compactum* coralline algal Mg/Ca ratios and comparison to high-resolution sea surface temperature data. Geochim Cosmochim Acta 220:96–109 doi:10.1016/j.gca.2017.09.044

Hind KR, Starko S, Burt JM, Lemay MA, Salomon AK, Martone PT (2019) Trophic control of cryptic coralline algal diversity. Proc Natl Acad Sci USA 116:15080–15085 PubMed doi:10.1073/pnas.1900506116

Hofmann L, Heesch S (2018) Latitudinal trends in stable isotope signatures and carbon-concentrating mechanisms of northeast Atlantic rhodoliths. Biogeosciences 15:6139–6149 doi:10.5194/bg-15-6139-2018

Hofmann LC, Straub S, Bischof K (2012) Competition between calcifying and noncalcifying temperate marine macroalgae under elevated CO2 levels. Mar Ecol Prog Ser 464:89–105 doi:10.3354/meps09892

Hofmann LC, Straub S, Bischof K (2013) Elevated CO2 levels affect the activity of nitrate reductase and carbonic anhydrase in the calcifying rhodophyte *Corallina officinalis*. J Exp Bot 64:899–908 PubMed doi:10.1093/jxb/ers369

Hofmann LC, Koch M, de Beer D (2016) Biotic control of surface pH and evidence of light-induced H+ pumping and Ca2+-H+ exchange in a tropical crustose coralline alga. PLoS One 11:e0159057 PubMed doi:10.1371/journal.pone.0159057

Hofmann LC, Schoenrock K, De Beer D (2018) Arctic coralline algae elevate surface pH and carbonate in the dark. Front Plant Sci 9:1416 PubMed doi:10.3389/fpls.2018.01416

Huff TM (2011) Effects of human trampling on macro and meiofauna communities associated with intertidal algal turfs and implications for management of protected areas on rocky shores (Southern California). PSZNI: Mar Ecol 32:335–345 doi:10.1111/j.1439-0485.2011.00467.x

Huggett MJ, McMahon K, Bernasconi R (2018) Future warming and acidification result in multiple ecological impacts to a temperate coralline alga. Environ Microbiol 20:2769–2782 PubMed doi:10.1111/1462-2920.14113

Hurd CL, Cornwall CE, Currie K, Hepburn CD, McGraw CM, Hunter KA, Boyd PW (2011) Metabolically induced pH fluctuations by some coastal calcifiers exceed projected 22nd century ocean acidification: a mechanism for differential susceptibility. Glob Change Biol 17:3254–3262 doi:10.1111/j.1365-2486.2011.02473.x

Incera M, Bertocci I, Benedetti-Cecchi L (2010) Effects of mean intensity and temporal variability of disturbance on the invasion of *Caulerpa racemosa* var. *cylindracea* (Caulerpales) in rock pools. Biol Invasions 12:501–514 doi:10.1007/s10530-009-9454-z

Janot K, Martone PT (2016) Convergence of joint mechanics in independently evolving, articulated coralline algae. J Exp Biol 219:383–391 PubMed doi:10.1242/jeb.131755

Janot KG, Martone PT (2018) Bending strategies of convergently evolved, articulated coralline algae. J Phycol 54:305–316 PubMed doi:10.1111/jpy.12639

Joher S, Ballesteros E, Cebrian E, Sánchez N, Rodríguez-Prieto C (2012) Deep-water macroalgal-dominated coastal detritic assemblages on the continental shelf off Mallorca and Menorca (Balearic islands, western Mediterranean). Bot Mar 55:485–497 doi:10.1515/bot-2012-0113

Johnson MD, Carpenter RC (2012) Ocean acidification and warming decrease calcification in the crustose coralline alga *Hydrolithon onkodes* and increase susceptibility to grazing. J Exp Mar Biol Ecol 434-435:94–101 doi:10.1016/j.jembe.2012.08.005

Johnson LE, Paine RT (2016) Consistency in a marine algal-grazer interaction over multiple scales. J Phycol 52:942–950 PubMed doi:10.1111/jpy.12475

Johnson KB, Roberts JL (2017) Florida inlets and intertidal biofouling communities. Mar Technol Soc J 51:7–21 doi:10.4031/MTSJ.51.2.2

Johnson MD, Price NN, Smith JE (2014) Contrasting effects of ocean acidification on tropical fleshy and calcareous algae. PeerJ 2:e411 PubMed doi:10.7717/peerj.411

Johnson MD, Rodriguez Bravo LM, O'Connor SE, Varley NF, Altieri AH (2019) pH variability exacerbates effects of ocean acidification on a Caribbean crustose coralline alga. Front Mar Sci 6:150 doi:10.3389/fmars.2019.00150

Jørgensbye HIØ, Halfar J (2017) Overview of coralline red algal crusts and rhodolith beds (Corallinales, Rhodophyta) and their possible ecological importance in Greenland. Polar Biol 40:517–531 doi:10.1007/s00300-016-1975-1

Jorissen H, Skinner C, Osinga R, De Beer D, Nugues MM (2016). Evidence for water-mediated mechanisms in coral–algal interactions. Proc Biol Sci, 283(1836), 20161137.

Joshi S, Duffy GP, Brown C (2014) Settling velocity and grain shape of maërl biogenic gravel. J Sediment Res 84:718–727 doi:10.2110/jsr.2014.51

Joshi S, Duffy GP, Brown C (2017) Critical bed shear stress and threshold of motion of maerl biogenic gravel. Estuar Coast Shelf Sci 194:128–142 doi:10.1016/j.ecss.2017.06.010

Kamenos NA, Law A (2010) Temperature controls on coralline algal skeletal growth. J Phycol 46:331–335 doi:10.1111/j.1529-8817.2009.00780.x

Kamenos NA, Hoey TB, Nienow P, Fallick AE, Claverie T (2012) Reconstructing Greenland ice sheet runoff using coralline algae. Geology 40:1095–1098 doi:10.1130/G33405.1

Kamenos NA, Burdett HL, Aloisio E, Findlay HS and others (2013) Coralline algal structure is more sensitive to rate, rather than the magnitude, of ocean acidification. Glob Change Biol 19:3621–3628 PubMed doi:10.1111/gcb.12351

Kamenos NA, Perna G, Gambi MC, Micheli F, Kroeker KJ (2016). Coralline algae in a naturally acidified ecosystem persist by maintaining control of skeletal mineralogy and size. Proc Biol Sci, 283(1840), 20161159.

Kang JY, Benliro IMP, Lee IJ, Choi JY and others (2013) Biological characteristics and tissue structure of a crustose coralline *Lithophyllum* alga. J Life Sci 23:341–346 doi:10.5352/JLS.2013.23.3.341

Kang JY, Hong YK, Benliro IMP, Lee IJ and others (2014a) Viability, fatty acid composition, and structure of the coralline alga *Corallina pilulifera.* Bot Sci 92:103–109 doi:10.17129/botsci.24

Kang JY, Choi JY, Joo J, Choi YS, Hwang DS, Cho JY, Hong YK (2014b) Effects of calcification inhibitors on the viability of the coralline algae *Lithophyllum yessoense* and *Corallina pilulifera.* Fish Aquat Sci 17:269–273 doi:10.5657/FAS.2014.0269

Kato A, Hikami M, Kumagai NH, Suzuki A, Nojiri Y, Sakai K (2014) Negative effects of ocean acidification on two crustose coralline species using genetically homogeneous samples. Mar Environ Res 94:1–6 PubMed doi:10.1016/j.marenvres.2013.10.010

Kim JH, Lam SMN, Kim KY (2013) Photoacclimation strategies of the temperate coralline alga *Corallina officinalis*: a perspective on photosynthesis, calcification, photosynthetic pigment contents and growth. Algae 28:355–363 doi:10.4490/algae.2013.28.4.355

Kim YD, Ahn JK, Nam MM, Lee C and others (2016) Characteristics of algal succession following rock scraping at Imwon area in the east coast of Korea. J Ocean Univ China 15:1087–1093 doi:10.1007/s11802-016-2743-0

Kim JH, Min J, Kang EJ, Kim KY (2018) Elevated temperature and changed carbonate chemistry: effects on calcification, photosynthesis, and growth of *Corallina officinalis* (Corallinales, Rhodophyta). Phycologia 57:280–286 doi:10.2216/17-71.1

Kolzenburg R, Nicastro KR, McCoy SJ, Ford AT, Zardi GI, Ragazzola F (2019) Understanding the margin squeeze: Differentiation in fitness-related traits between central and trailing edge populations of *Corallina officinalis.* Ecol Evol 9:5787–5801 PubMed doi:10.1002/ece3.5162

Konar B (2013) Lack of recovery from disturbance in high-arctic boulder communities. Polar Biol 36:1205–1214 doi:10.1007/s00300-013-1340-6

Korbee N, Navarro NP, García-Sánchez M, Celis-Plá PSM and others (2014) A novel in situ system to evaluate the effect of high CO2 on photosynthesis and biochemistry of seaweeds. Aquat Biol 22:245–259 doi:10.3354/ab00594

Kram SL, Price NN, Donham EM, Johnson MD, Kelly ELA, Hamilton SL, Smith JE (2016) Variable responses of temperate calcified and fleshy macroalgae to elevated p CO2 and warming. ICES J Mar Sci 73:693–703 doi:10.1093/icesjms/fsv168

Krayesky-Self S, Richards JL, Rahmatian M, Fredericq S (2016) Aragonite infill in overgrown conceptacles of coralline *Lithothamnion* spp.(Hapalidiaceae, Hapalidiales, Rhodophyta): new insights in biomineralization and phylomineralogy. J Phycol 52:161–173 PubMed doi:10.1111/jpy.12392

Krayesky-Self S, Schmidt WE, Phung D, Henry C and others (2017) Eukaryotic life inhabits rhodolith-forming coralline algae (Hapalidiales, Rhodophyta), remarkable marine benthic microhabitats. Sci Rep 7: 45850 PubMed doi:10.1038/srep45850

Lecchini D, Bertucci F, Gache C, Khalife A and others (2018) Boat noise prevents soundscape-based habitat selection by coral planulae. Sci Rep 8:9283 PubMed doi:10.1038/s41598-018-27674-w

Legrand E, Riera P, Lutier M, Coudret J, Grall J, Martin S (2017) Species interactions can shift the response of a maerl bed community to ocean acidification and warming. Biogeosciences 14:5359–5376 doi:10.5194/bg-14-5359-2017

Legrand E, Riera P, Bohner O, Coudret J, Schlicklin F, Derrien M, Martin S (2018a) Impact of ocean acidification and warming on the productivity of a rock pool community. Mar Environ Res 136:78–88 PubMed doi:10.1016/j.marenvres.2018.02.010

Legrand E, Riera P, Pouliquen L, Bohner O, Cariou T, Martin S (2018b) Ecological characterization of intertidal rockpools: Seasonal and diurnal monitoring of physico-chemical parameters. Reg Stud Mar Sci 17:1–10 doi:10.1016/j.rsma.2017.11.003

Legrand E, Riera P, Lutier M, Coudret J, Grall J, Martin S (2019) Grazers increase the sensitivity of coralline algae to ocean acidification and warming. J Sea Res 148-149:1–7 doi:10.1016/j.seares.2019.03.001

Lei X, Huang H, Lian J, Zhou G, Jiang L (2018) Community structure of coralline algae and its relationship with environment in Sanya reefs, China. Aquat Ecosyst Health Manage 21:19–29 doi:10.1080/14634988.2018.1432954

Lewis B, Diaz-Pulido G (2017) Suitability of three fluorochrome markers for obtaining in situ growth rates of coralline algae. J Exp Mar Biol Ecol 490:64–73 doi:10.1016/j.jembe.2017.02.004

Lewis B, Kennedy EV, Diaz-Pulido G (2017a) Seasonal growth and calcification of a reef-building crustose coralline alga on the Great Barrier Reef. Mar Ecol Prog Ser 568:73–86 doi:10.3354/meps12074

Lewis B, Lough JM, Nash MC, Diaz-Pulido G (2017b) Presence of skeletal banding in a reef-building tropical crustose coralline alga. PLoS One 12: e0185124 PubMed

Light T, Williams B, Halfar J, Hou A, Zajacz Z, Tsay A, Adey W (2018) Advancing Mg/Ca Analysis of Coralline Algae as a Climate Proxy by Assessing LA-ICP-OES Sampling and

Coupled Mg/Ca-18O Analysis. Geochem Geophys Geosyst 19:2876–2894 doi:10.1029/2018GC007504

Linares C, Vidal M, Canals M, Kersting DK and others (2015) Persistent natural acification drives major distribution shifts in marine benthic ecosystems. Proc Biol Sci 282:20150587 PubMed

Littler MM, Littler DS, Brooks BL (2010) The effects of nitrogen and phosphorus enrichment on algal community development: Artificial mini-reefs on the Belize Barrier Reef sedimentary lagoon. Harmful Algae 9:255–263 doi:10.1016/j.hal.2009.11.002

Maggi E, Bulleri F, Bertocci I, Benedetti-Cecchi L (2012) Competitive ability of macroalgal canopies overwhelms the effects of variable regimes of disturbance. Mar Ecol Prog Ser 465:99–109 doi:10.3354/meps09903

Magill CL, Maggs CA, Johnson MP, O'Connor N (2019) Sustainable harvesting of the ecosystem engineer Corallina officinalis for biomaterials. Front Mar Sci 6:285 doi:10.3389/fmars.2019.00285

Manning JC, Carpenter RC, Miranda EA (2019) Ocean acidification reduces net calcification and wound healing in the tropical crustose coralline alga, *Porolithon onkodes* (Corallinales, Rhodophyta). J Exp Mar Biol Ecol 520:151225 doi:10.1016/j.jembe.2019.151225

Marchini A, Ragazzola F, Vasapollo C, Castelli A and others (2019) Intertidal Mediterranean coralline algae habitat is expecting a shift toward a reduced growth and a simplified associated fauna under climate change. Front Mar Sci 6:106 doi:10.3389/fmars.2019.00106

Mariath R, Rodriguez RR, Figueiredo MA (2013) Succession of crustose coralline red algae (Rhodophyta) on coralgal reefs exposed to physical disturbance in the southwest Atlantic. Helgol Mar Res 67:687 doi:10.1007/s10152-013-0354-3

Martin S, Charnoz A, Gattuso JP (2013a) Photosynthesis, respiration and calcification in the Mediterranean crustose coralline alga *Lithophyllum cabiochae* (Corallinales, Rhodophyta). Eur J Phycol 48:163–172 doi:10.1080/09670262.2013.786790

Martin S, Cohu S, Vignot C, Zimmerman G, Gattuso JP (2013b) One-year experiment on the physiological response of the Mediterranean crustose coralline alga, *Lithophyllum cabiochae*, to elevated p CO 2 and temperature. Ecol Evol 3:676–693 PubMed doi:10.1002/ece3.475

Martínez-Laiz G, Ros M, Navarro-Barranco C, Guerra-García JM (2018) Habitat selection of intertidal caprellid amphipods in a changing scenario. Behav Processes 153:16–24 PubMed doi:10.1016/j.beproc.2018.05.005

Martone PT (2010) Quantifying growth and calcium carbonate deposition of *Calliarthron cheilosporioides* (Corallinales, Rhodophyta) in the field using a persistent vital stain. J Phycol 46:13–17 doi:10.1111/j.1529-8817.2009.00770.x

Martone PT, Alyono M, Stites S (2010a) Bleaching of an intertidal coralline alga: untangling the effects of light, temperature, and desiccation. Mar Ecol Prog Ser 416:57–67 doi:10.3354/meps08782

Martone PT, Navarro DA, Stortz CA, Estevez JM (2010b) Differences in polysaccharide structure between calcified and uncalcified segments in the coralline *Calliarthron*

cheilosporioides (Corallinales, Rhodophyta). J Phycol 46:507–515 doi:10.1111/j.1529-8817.2010.00828.x

Matsuda S, Iryu Y (2011) Rhodoliths from deep fore-reef to shelf areas around Okinawa-jima, Ryukyu Islands, Japan. Mar Geol 282:215–230 doi:10.1016/j.margeo.2011.02.013

McConnico LA, Foster MS, Steller DL, Riosmena-Rodríguez R (2014) Population biology of a long-lived rhodolith: the consequences of becoming old and large. Mar Ecol Prog Ser 504:109–118 doi:10.3354/meps10780

McConnico LA, Carmona GH, Morales JSM, Rodríguez RR (2017) Temporal variation in seaweed and invertebrate assemblages in shallow rhodolith beds of Baja California Sur, México. Aquat Bot 139:37–47 doi:10.1016/j.aquabot.2017.02.007

McCoy SJ (2013) Morphology of the crustose coralline alga *Pseudolithophyllum muricatum* (Corallinales, Rhodophyta) responds to 30 years of ocean acidification in the Northeast Pacific. J Phycol 49:830–837 PubMed

McCoy SJ, Kamenos NA (2018) Coralline algal skeletal mineralogy affects grazer impacts. Glob Change Biol 24:4775–4783 PubMed doi:10.1111/gcb.14370

McCoy SJ, Pfister CA (2014) Historical comparisons reveal altered competitive interactions in a guild of crustose coralline algae. Ecol Lett 17:475–483 PubMed doi:10.1111/ele.12247

McCoy SJ, Ragazzola F (2014) Skeletal trade-offs in coralline algae in response to ocean acidification. Nat Clim Chang 4:719 doi:10.1038/nclimate2273

McCoy SJ, Widdicombe S (2019) Thermal plasticity is independent of environmental history in an intertidal seaweed. Ecol Evol 9:13402–13412 PubMed doi:10.1002/ece3.5796

McCoy SJ, Pfister CA, Olack G, Colman AS (2016) Diurnal and tidal patterns of carbon uptake and calcification in geniculate intertidal coralline algae. PSZNI: Mar Ecol 37:553–564 doi:10.1111/maec.12295

McCoy SJ, Santillán-Sarmiento A, Brown MT, Widdicombe S, Wheeler GL (2020) Photosynthetic responses of turf-forming red macroalgae to high co 2 conditions. J Phycol 56:85–96 PubMed doi:10.1111/jpy.12922

McNicholl C, Koch MS, Hofmann LC (2019) Photosynthesis and light-dependent proton pumps increase boundary layer pH in tropical macroalgae: A proposed mechanism to sustain calcification under ocean acidification. J Exp Mar Biol Ecol 521:151208 doi:10.1016/j.jembe.2019.151208

Meistertzheim AL, Nugues MM, Quere G, Galand PE (2017) Pathobiomes differ between two diseases affecting reef building coralline algae. Front Microbiol 8:1686 PubMed doi:10.3389/fmicb.2017.01686

Melbourne LA, Griffin J, Schmidt DN, Rayfield EJ (2015) Potential and limitations of finite element modelling in assessing structural integrity of coralline algae under future global change. Biogeosciences 12:5871–5883 doi:10.5194/bg-12-5871-2015

Melbourne LA, Denny MW, Harniman RL, Rayfield EJ, Schmidt DN (2018) The importance of wave exposure on the structural integrity of rhodoliths. J Exp Mar Biol Ecol 503:109–119 doi:10.1016/j.jembe.2017.11.007

Melero I, Lopez-Velasco S, Lopez E (2017) On the role of turf species as refuge in disturbed environments: A case study with polychaetes (Annelida: Polychaeta) in the SW Mediterranean Sea. Mediterr Mar Sci 18:229–240 doi:10.12681/mms.2050

Méndez-Sandín M, Fernández C (2016) Changes in the structure and dynamics of marine assemblages dominated by *Bifurcaria bifurcata* and *Cystoseira* species over three decades (1977–2007). Estuar Coast Shelf Sci 175:46–56 doi:10.1016/j.ecss.2016.03.015

Mendoza González AC, Mateo-Cid LE, García López DY, Acosta-Calderón JA (2014) Diversity and distribution of articulated coralline algae (rhodophyta, corallinales) of the Atlantic coast of Mexico. Phytotaxa 190:45–63 doi:10.11646/phytotaxa.190.1.6

Mirlean N, Baisch P, Garcia F, Seus E, Silva-Silveira E, Vicenti J (2016) Coralline algae and arsenic fixation in near shore sediments. Reg Stud Mar Sci 3:83–88 doi:10.1016/j.rsma.2015.06.005

Mogstad AA, Johnsen G (2017) Spectral characteristics of coralline algae: a multi-instrumental approach, with emphasis on underwater hyperspectral imaging. Appl Opt 56:9957–9975 doi:10.1364/AO.56.009957

Moreira-González AR, Fernández-Garcés R, Gómez-Batista M, León-Pérez ÁR and others (2019) Marine red algae from central-southern coast of Cuba. Reg Stud Mar Sci 25:100450 doi:10.1016/j.rsma.2018.100450

Moura RL, Amado-Filho GM, Moraes FC, Brasileiro PS and others (2016) An extensive reef system at the Amazon River mouth. Sci Adv 2:e1501252 PubMed doi:10.1126/sciadv.1501252

Muñoz PT, Sáez CA, Martínez-Callejas MB, Flores-Molina MR and others (2018) Short-term interactive effects of increased temperatures and acidification on the calcifying macroalgae *Lithothamnion crispatum* and *Sonderophycus capensis*. Aquat Bot 148:46–52 doi:10.1016/j.aquabot.2018.04.008

Nannini M, De Marchi L, Lombardi C, Ragazzola F (2015) Effects of thermal stress on the growth of an intertidal population of *Ellisolandia elongata* (Rhodophyta) from N-W Mediterranean Sea. Mar Environ Res 112:11–19 PubMed doi:10.1016/j.marenvres.2015.05.005

Nash MC, Adey W (2017) Multiple phases of mg-calcite in crustose coralline algae suggest caution for temperature proxy and ocean acidification assessment: lessons from the ultrastructure and biomineralization in *Phymatolithon* (Rhodophyta, Corallinales). J Phycol 53:970–984 PubMed doi:10.1111/jpy.12559

Nash MC, Adey W (2018) Anatomical structure overrides temperature controls on magnesium uptake–calcification in the Arctic/subarctic coralline algae *Leptophytum laeve* and *Kvaleya epilaeve* (Rhodophyta; Corallinales). Biogeosciences 15:781–795 doi:10.5194/bg-15-781-2018

Nash M, Troitzsch U, Opdyke B, Trafford J, Russell B, Kline D (2011) First discovery of dolomite and magnesite in living coralline algae and its geobiological implications. Biogeosciences 8:3331–3340 doi:10.5194/bg-8-3331-2011

Nash MC, Opdyke BN, Troitzsch U, Russell BD and others (2013) Dolomite-rich coralline algae in reefs resist dissolution in acidified conditions. Nat Clim Chang 3:268 doi:10.1038/nclimate1760

Nash MC, Uthicke S, Negri AP, Cantin NE (2015) Ocean acidification does not affect magnesium composition or dolomite formation in living crustose coralline algae, *Porolithon onkodes* in an experimental system. Biogeosciences 12:5247–5260 doi:10.5194/bg-12-5247-2015

Nash MC, Martin S, Gattuso JP (2016) Mineralogical response of the Mediterranean crustose coralline alga *Lithophyllum cabiochae* to near-future ocean acidification and warming. Biogeosciences 13:5937–5945 doi:10.5194/bg-13-5937-2016

Nash MC, Diaz-Pulido G, Harvey AS, Adey W (2019) Coralline algal calcification: A morphological and process-based understanding. PLoS One 14:e0221396 PubMed doi:10.1371/journal.pone.0221396

Negri AP, Flores F, Röthig T, Uthicke S (2011) Herbicides increase the vulnerability of corals to rising sea surface temperature. Limnol Oceanogr 56:471–485 doi:10.4319/lo.2011.56.2.0471

Neill KF, Nelson WA, D'Archino R, Leduc D, Farr TJ (2015) Northern New Zealand rhodoliths: assessing faunal and floral diversity in physically contrasting beds. Mar Biodivers 45:63–75 doi:10.1007/s12526-014-0229-0

Nelson W, D'Archino R, Neill K, Farr T (2014) Macroalgal diversity associated with rhodolith beds in northern New Zealand. Cryptogam, Algol 35:27–48 doi:10.7872/crya.v35.iss1.2014.27

Nielsen SJ, Harder T, Steinberg PD (2015) Sea urchin larvae decipher the epiphytic bacterial community composition when selecting sites for attachment and metamorphosis. FEMS Microbiol Ecol 91:1–9 PubMed doi:10.1093/femsec/fiu011

Nilssen I, dos Santos F, Coutinho R, Gomes N and others (2015) Assessing the potantial impact of water-based drill cuttings on deep-water calcareous red algae suing species specific impact categories and measured oceanographic and discharge data. Mar Environ Res 112:68–77 PubMed doi:10.1016/j.marenvres.2015.09.008

Nitsch F, Nebelsick JH, Bassi D (2015) Constructional and destructional patterns--void classification of rhodoliths from Giglio Island, Italy. Palios 30:680–691 doi:10.2110/palo.2015.007

Nogueira P, Gambi MC, Vizzini S, Califano G, Tavares AM, Santos R, Martinez-Crego B (2017) Altered epiphyte community and sea urchin diet in *Posidonia oceanica* meadows in the vicinity of volcanic CO2 vents. Mar Environ Res 127:102–111 PubMed doi:10.1016/j.marenvres.2017.04.002

Noisette F, Egilsdottir H, Davoult D, Martin S (2013a) Physiological responses of three temperate coralline algae from contrasting habitats to near-future ocean acidification. J Exp Mar Biol Ecol 448:179–187 doi:10.1016/j.jembe.2013.07.006

Noisette F, Duong G, Six C, Davoult D, Martin S (2013b) Effects of elevated p CO2 on the metabolism of a temperate rhodolith *Lithothamnion corallioides* grown under different temperatures. J Phycol 49:746–757 PubMed doi:10.1111/jpy.12085

Noseworthy RG, Choi KS (2010) The diversity and ecology of mollusks in Seogundo off the southern Jeju Island, Republic of Korea. Korean J Malacol 26:19–31

O'Leary JK, Potts DC, Braga JC, McClanahan TR (2012) Indirect consequences of fishing: reduction of coralline algae suppresses juvenile coral abundance. Coral Reefs 31:547–559 doi:10.1007/s00338-012-0872-5

O'Leary JK, Barry JP, Gabrielson PW, Rogers-Bennett L, Potts DC, Palumbi SR, Micheli F (2017) Calcifying algae maintain settlement cues to larval abalone following algal exposure to extreme ocean acidification. Sci Rep 7:5774 PubMed doi:10.1038/s41598-017-00036-8

O'Reilly SS, Hurley S, Coleman N, Monteys X, Szpak M, O'Dwyer T, Kelleher BP (2012) Chemical and physical features of living and non-living maerl rhodoliths. Aquat Biol 15:215–224 doi:10.3354/ab00431

Olabarria C, Arenas F, Viejo RM, Gestoso I and others (2013) Response of macroalgal assemblages from rockpools to climate change: effects of persistent increase in temperature and CO2. Oikos 122:1065–1079 doi:10.1111/j.1600-0706.2012.20825.x

Oliveira JP, Bertocci I, Weber GM, Sousa-Pinto I (2011) Type and timing of disturbance modify trajectories of recovery of rockpool assemblages at Aguda (NW Portugal). J Exp Mar Biol Ecol 399:135–141 doi:10.1016/j.jembe.2011.01.023

Ordoñez A, Doropoulos C, Diaz-Pulido G (2014) Effects of ocean acidification on population dynamics and community structure of crustose coralline algae. Biol Bull 226:255–268 PubMed doi:10.1086/BBLv226n3p255

Ordoñez A, Kennedy EV, Diaz-Pulido G (2017) Reduced spore germination explains sensitivity of reef-building algae to climate change stressors. PLoS One 12: e0189122 PubMed doi:10.1371/journal.pone.0189122

Orlando-Bonaca M, Mavrič B, Lipej L, Kaleb S, Falace A (2017). Coralline algae on biogenic formations in marine waters off Slovenia (northern Adriatic Sea). In Annales: Series Historia Naturalis (Vol. 27, No. 2, pp. 89-96). Scientific and Research Center of the Republic of Slovenia.

Osterloff J, Nilssen I, Eide I, de Oliveira Figueiredo MA, de Souza Tâmega FT, Nattkemper TW (2016) Computational visual stress level analysis of calcareous algae exposed to sedimentation. PLoS One 11:e0157329 PubMed doi:10.1371/journal.pone.0157329

Padilla-Gamiño JL, Gaitán-Espitia JD, Kelly MW, Hofmann GE (2016) Physiological plasticity and local adaptation to elevated pCO 2 in calcareous algae: an ontogenetic and geographic approach. Evol Appl 9:1043–1053 PubMed doi:10.1111/eva.12411

Page HN, Andersson AJ, Jokiel PL, Ku'ulei SR and others (2016) Differential modification of seawater carbonate chemistry by major coral reef benthic communities. Coral Reefs 35:1311–1325 doi:10.1007/s00338-016-1490-4

Page TM, McDougall C, Diaz-Pulido G (2019) De novo transcriptome assembly for four species of crustose coralline algae and analysis of unique orthologous genes. Sci Rep 9:12611 PubMed doi:10.1038/s41598-018-37186-2

Parada GM, Martinez EA, Aguilera MA, Orostica MH, Broitman BR (2017) Interactions between kelp spores and encrusting and articulated corallines: recruitment challenges for *Lessonia spicata.* Bot Mar 60:619–625 doi:10.1515/bot-2017-0010

Pardo C, Lopez L, Peña V, Hernández-Kantún J, Le Gall L, Bárbara I, Barreiro R (2014) A multilocus species delimitation reveals a striking number of species of coralline algae forming maerl in the OSPAR maritime area. PLoS One 9:e104073 PubMed doi:10.1371/journal.pone.0104073

Pardo C, Bárbara I, Barreiro R, Peña V (2017) Insights into species diversity of associated crustose coralline algae (Corallinophycidae, Rhodophyta) with Atlantic European maerl beds using DNA barcoding. An Jardin Botanico Madr 1979 74. doi:10.3989/ajbm.2459 doi:10.3989/ajbm.2459

Pascelli C, Riul P, Riosmena-Rodríguez R, Scherner F and others (2013) Seasonal and depth-driven changes in rhodolith bed structure and associated macroalgae off Arvoredo island (southeastern Brazil). Aquat Bot 111:62–65 doi:10.1016/j.aquabot.2013.05.009

Pauly M, Kamenos NA, Donohue P, LeDew E (2015) Coralline algal Mg-O bond strength as a marine pCO2 proxy. Geology 43:267–270 doi:10.1130/G36386.1

Peach KE, Koch MS, Blackwelder PL (2016) Effects of elevated pCO2 and irradiance on growth, photosynthesis and calcification in *Halimeda discoidea.* Mar Ecol Prog Ser 544:143–158 doi:10.3354/meps11591

Pearse, J. S., Doyle, W. T, Pearse, V. B., Gowing, M. M, Pennington, J. T., Danner, E. & Wasser, A. (2015) Long-term monitoring of surfgrass meadows in the Monterey Bay National Marine Sanctuary; Recovery followed by stability after the termination of a domestic sewage discharge. Marine Sanctuaries Conservation Series, 15-10, 1-51.

Peña V, Bárbara I (2010) Seasonal patterns in the maerl community of shallow European Atlantic beds and their use as a baseline for monitoring studies. Eur J Phycol 45:327–342 doi:10.1080/09670261003586938

Peña MR, Bautista JI, Buen-Ursua SM, Bayona N, Titular VST (2010) Settlement, growth and survival of the donkey's ear abalone *Haliotis asinina* (Linne) in response to diatom diets and attachment substrate. Philipp J Sci 139:27–34

Pereira-Filho GH, Amado-Filho GM, Guimarães SM, Moura RL and others (2011) Reef fish and benthic assemblages of the Trindade and Martin Vaz island group, southwestern Atlantic. Braz J Oceanogr 59:201–212 doi:10.1590/S1679-87592011000300001

Pereira-Filho GH, Amado-Filho GM, De Moura RL, Bastos AC and others (2012) Extensive rhodolith beds cover the summits of southwestern Atlantic Ocean seamounts. J Coast Res 28:261–269 doi:10.2112/11T-00007.1

Pereira-Filho GH, Shintate GS, Kitahara MV, Moura RL and others (2019) The southernmost Atlantic coral reef is off the subtropical island of Queimada Grande (24 S), Brazil. Bull Mar Sci 95:277–287 doi:10.5343/bms.2018.0056

Perkins RG, Williamson CJ, Brodie J, Barillé L and others (2016) Microspatial variability in community structure and photophysiology of calcified macroalgal microbiomes revealed by coupling of hyperspectral and high-resolution fluorescence imaging. Sci Rep 6:22343 PubMed doi:10.1038/srep22343

Pezzolesi L, Falace A, Kaleb S, Hernandez-Kantun JJ, Cerrano C, Rindi F (2017) Genetic and morphological variation in an ecosystem engineer, *Lithophyllum byssoides* (Corallinales, Rhodophyta). J Phycol 53:146–160 PubMed doi:10.1111/jpy.12488

Pickett M, Andersson AJ (2015) Dissolution rates of biogenic carbonates in natural seawater at different pCO2 conditions: a laboratory study. Aquat Geochem 21:459–485 doi:10.1007/s10498-015-9261-3

Pollock FJ, Katz SM, van de Water J, Davies SW and others (2017) Coral larvae for restoration and research: a large-scale method for rearing *Acropora millepora* larvae, inducing settlement, and establishing symbiosis. PeerJ 5: e3732 PubMed doi:10.7717/peerj.3732

Porzio L, Buia MC, Hall-Spencer JM (2011) Effects of ocean acidification on macroalgal communities. J Exp Mar Biol Ecol 400:278–287 doi:10.1016/j.jembe.2011.02.011

Porzio L, Buia MC, Lorenti M, Vitale E, Amitrano C, Arena C (2018a) Ecophysiological response of *Jania rubens* (Corallinaceae) to ocean acidification. Rend Lincei Sci Fis Nat 29:543–546 doi:10.1007/s12210-018-0719-2

Porzio L, Buia MC, Ferretti V, Lorenti M and others (2018b) Photosynthesis and mineralogy of *Jania rubens* at low pH/high pCO2: A future perspective. Sci Total Environ 628-629:375–383 PubMed doi:10.1016/j.scitotenv.2018.02.065

Price N (2010) Habitat selection, fcilitation, and biotic settlement cues affect distribution and performance of coral recruits in French Polynesia. Oecologia 163:747–758 PubMed doi:10.1007/s00442-010-1578-4

Quéré G, Meistertzheim AL Steneck, R. S., & Nugues, M. M. (2015). Histopathology of crustose coralline algae affected by whaite band and white patch diseases. PeerJ. doi:10.7717/peerj.1034 PubMed

Quéré G, Nugues MM (2015) Coralline algae disease reduces survival and settlement success of coral planulae in laboratory experiments. Coral Reefs 34:863–870 doi:10.1007/s00338-015-1292-0

Quéré G, Steneck RS, Nugues MM (2015) Spatiotemporal and species-specific patterns of diseases affecting crustose coralline algae in Curaçao. Coral Reefs 34:259–273 doi:10.1007/s00338-014-1225-3

Qui-Minet ZN, Delaunay C, Grall J, Six C and others (2018) The role of local environmental changes on maerl and its associated non-calcareous epiphytic flora in the Bay of Brest. Estuar Coast Shelf Sci 208:140–152 doi:10.1016/j.ecss.2018.04.032

Qui-Minet ZN, Coudret J, Davoult D, Grall J, Mendez-Sandin M, Cariou T, Martin S (2019) Combined effects of global climate change and nutrient enrichment on the physiology of three temperate maerl species. Ecol Evol 9:13787–13807 PubMed doi:10.1002/ece3.5802

Quinlan ZAD, Ritson-Williams R, Carroll BJ, Carlson CA, Nelson CE (2019) Species-specific differences in the microbiomes and organic exudates of crustose coralline algae influence bacterioplankton communities. Front Microbiol 10:2397 PubMed doi:10.3389/fmicb.2019.02397

Ragazzola F, Foster LC, Form A, Anderson PS, Hansteen TH, Fietzke J (2012) Ocean acidification weakens the structural integrity of coralline algae. Glob Change Biol 18:2804–2812 PubMed doi:10.1111/j.1365-2486.2012.02756.x

Ragazzola F, Foster LC, Form AU, Büscher J, Hansteen TH, Fietzke J (2013) Phenotypic plasticity of coralline algae in a high CO 2 world. Ecol Evol 3:3436–3446 PubMed

Ragazzola F, Foster LC, Jones CJ, Scott TB, Fietzke J, Kilburn MR, Schmidt DN (2016) Impact of high CO2 on the geochemistry of the coralline algae *Lithothamnion glaciale.* Sci Rep 6:20572 PubMed doi:10.1038/srep20572

Ragazzola F, Raiteri G, Fabbri P, Scafe M, Florio M, Nannini M, Lombardi C (2017) Structural integrity of *Ellisolandia elongata* reefs: A mechanical approach to compare tensile strengths in natural and controlled environments. Mar Ecol 38: e12455 doi:10.1111/maec.12455

Rahman MA, Halfar J (2014) First evidence of chitin in calcified coralline algae: new insights into the calcification process of *Clathromorphum compactum.* Sci Rep 4:6162 PubMed doi:10.1038/srep06162

Rahman MA, Halfar J, Adey WH, Nash M, Paulo C, Dittrich M (2019) The role of chitin-rich skeletal organic matrix on the crystallization of calcium carbonate in the crustose coralline alga *Leptophytum foecundum.* Sci Rep 9:11869 PubMed doi:10.1038/s41598-019-47785-2

Rebelo AC, Johnson ME, Quartau R, Rasser MW and others (2018) Modern rhodoliths from the insular shelf of Pico in the Azores (Northeast Atlantic Ocean). Estuar Coast Shelf Sci 210:7–17 doi:10.1016/j.ecss.2018.05.029

Reyes-Nivia C, Diaz-Pulido G, Dove S (2014) Relative roles of endolithic algae and carbonate chemistry variability in the skeletal dissolution of crustose coralline algae. Biogeosciences 11:4615–4626 doi:10.5194/bg-11-4615-2014

Ricardo GF, Jones RJ, Nordborg M, Negri AP (2017) Settlement patterns of the coral *Acropora millepora* on sediment-laden surfaces. Sci Total Environ 609:277–288 PubMed doi:10.1016/j.scitotenv.2017.07.153

Rich WA, Schubert N, Schläpfer N, Carvalho VF, Horta AC, Horta PA (2018) Physiological and biochemical responses of a coralline alga and a sea urchin to climate change: Implications for herbivory. Mar Environ Res 142:100–107 PubMed doi:10.1016/j.marenvres.2018.09.026

Ries JB (2011) Skeletal mineralogy in a high-CO2 world. J Exp Mar Biol Ecol 403:54–64 doi:10.1016/j.jembe.2011.04.006

Ries JB, Ghazaleh MN, Connolly B, Westfield I, Castillo KD (2016) Impacts of seawater saturation state (A= 0.4–4.6) and temperature (10, 25° C) on the dissolution kinetics of whole-shell biogenic carbonates. Geochim Cosmochim Acta 192:318–337 doi:10.1016/j.gca.2016.07.001

Riosmena-Rodriguez R, Lopez-Calderon JM, Mariano-Melendez E, Sanchez-Rodriguez A, Fernandez-Garcia C (2012) Size and distribution of rhodolith beds in the Loreto marine park: Their role in coastal processes. J Coast Res 28:255–260 doi:10.2112/JCOASTRES-D-11T-00008.1

Ritson-Williams R, Paul VJ, Arnold SN, Steneck RS (2010) Larval settlement preferences and post-settlement survival of the threatened Caribbean corals *Acropora palmata* and *A. cervicornis.* Coral Reefs 29:71–81 doi:10.1007/s00338-009-0555-z

Ritson-Williams R, Arnold SN, Paul VJ (2016) Patterns of larval settlement preferences and post-settlement survival for seven Caribbean corals. Mar Ecol Prog Ser 548:127–138 doi:10.3354/meps11688

Rix LN, Burdett HL, Kamenos NA (2012) Irradiance-mediated dimethylsulphoniopropionate (DMSP) responses of red coralline algae. Estuar Coast Shelf Sci 96:268–272 doi:10.1016/j.ecss.2011.11.022

Roberts RD, Watts E (2010) Settlement of *Haliotis australis* larvae: role of cues and oritntation of the substratum. J Shellfish Res 29:663–670 doi:10.2983/035.029.0316

Roberts RD, Barker MF, Mladenov P (2010) Is settlement of *Haliotis Iris* larvae on coralline algae triggered by the alga or its surface biofilm. J Shellfish Res 29:671–678 doi:10.2983/035.029.0317

Roleda MY, Cornwall CE, Feng Y, McGraw CM, Smith AM, Hurd CL (2015) Effect of ocean acidification and pH fluctuations on the growth and development of coralline algal

recruits, and an associated benthic algal assemblage. PLoS One 10: e0140394 PubMed doi:10.1371/journal.pone.0140394

Russell BD, Passarelli CA, Connell SD (2011) Forecasted CO_2 modifies the influence of light in shaping subtidal habitat. J Phycol 47:744–752 PubMed doi:10.1111/j.1529-8817.2011.01002.x

Sañé E, Chiocci FL, Basso D, Martorelli E (2016) Environmental factors controlling the distribution of rhodoliths: An integrated study based on seafloor sampling, ROV and side scan sonar data, offshore the W-Pontine Archipelago. Cont Shelf Res 129:10–22 doi:10.1016/j.csr.2016.09.003

Sangil C, Sansón M, Díaz-Villa T, Hernández JC, Clemente S, Afonso-Carrillo J (2014) Spatial variability, structure and composition of crustose algal communities in *Diadema africanum* barrens. Helgol Mar Res 68:451–464 doi:10.1007/s10152-014-0401-8

Sangil C, Clemente S, Brito A, Rodríguez A and others (2016) Seaweed community response to a massive CO2 input. Estuar Coast Shelf Sci 178:48–57 doi:10.1016/j.ecss.2016.05.025

Sarkar S, Sarkar S (2016) Diversity of corals and benthic algae across the shallow-water reefs of Andaman Islands: managing the valuable ecosystems. Environ Dev Sustain 18:1801–1814 doi:10.1007/s10668-015-9709-z

Savini A, Basso D, Bracchi VA, Corselli C, Pennetta M (2012) Maerl-bed mapping and carbonate quantification on submerged terraces offshore the Cilento peninsula (Tyrrhenian Sea, Italy). Geodiversitas 34:77–98 doi:10.5252/g2012n1a5

Schafer P, Fortunato H, Bader B, Liebetrau V, Bauch T, Reijmer JJG (2011) Growth rates and carbonate production by coralline red algae in upwelling and non-upwelling settings along the Pacific coast of Panama. Palaios 26:420–432 doi:10.2110/palo.2010.p10-138r

Scherner F, Riul P, Bastos E, Bouzon ZL and others (2010) Herbivory in a rhodolith bed: a structuring factor. Pan-Am J Aquat Sci 5:358–366

Schiel DR, Lilley SA (2011) Impacts and negative feedbacks in community recovery over eight years following removal of habitat-forming macroalgae. J Exp Mar Biol Ecol 407:108–115 doi:10.1016/j.jembe.2011.07.004

Schiel DR, Thompson GA (2012) Demography and population biology of the invasive kelp *Undaria pinnatifida* on shallow reefs in southern New Zealand. J Exp Mar Biol Ecol 434-435:25–33 doi:10.1016/j.jembe.2012.07.023

Schoenrock KM, Schram JB, Amsler CD, McClintock JB, Angus RA, Vohra YK (2016) Climate change confers a potential advantage to fleshy Antarctic crustose macroalgae over calcified species. J Exp Mar Biol Ecol 474:58–66 doi:10.1016/j.jembe.2015.09.009

Schoenrock KM, Bacquet M, Pearce D, Rea BR and others (2018) Influences of salinity on the physiology and distribution of the Arctic coralline algae, *Lithothamnion glaciale* (Corallinales, Rhodophyta). J Phycol 54:690–702 PubMed doi:10.1111/jpy.12774

Schubert N, Salazar VW, Rich WA, Vivanco Bercovich M and others (2019) Rhodolith primary and carbonate production in a changing ocean: The interplay of warming and nutrients. Sci Total Environ 676:455–468 PubMed doi:10.1016/j.scitotenv.2019.04.280

Short J, Kendrick GA, Falter J, McCulloch MT (2014) Interactions between filamentous turf algae and coralline algae are modified under ocean acidification. J Exp Mar Biol Ecol 456:70–77 doi:10.1016/j.jembe.2014.03.014

Short J, Foster T, Falter J, Kendrick GA, McCulloch MT (2015) Crustose coralline algal growth, calcification and mortality folloowing a marine heatwave in Western Australia. Cont Shelf Res 106:38–44 doi:10.1016/j.csr.2015.07.003

Siboni N, Abrego D, Motti CA, Tebben J, Harder T (2014) gene expression patterns during the early stages of chemically induced larval metamorphosis and settlement of the coral *Acropora millepora.* PLoS One 9:e91082 PubMed doi:10.1371/journal.pone.0091082

Siboni N, Abrego D, Evenhuis C, Logan M, Motti CA (2015) Adaptation to local thermal regimes by crustose coralline algae does not affect rates of recruitment in coral larvae. Coral Reefs 34:1243–1253 doi:10.1007/s00338-015-1346-3

Sini M, Garrabou J, Trygonis V, Koutsoubas D (2019) Coralligenous formations dominated by *Eunicella cavolini* (Koch, 1887) in the NE Mediterranean: biodiversity and structure. Mediterr Mar Sci 20:174–188

Sletten HR, Andrus CFT, Guzmán HM, Halfar J (2017a) Re-evaluation of using rhodolith growth patterns for paleoenvironmental reconstruction: An example from the Gulf of Panama. Palaeogeogr Palaeoclimatol Palaeoecol 465:264–277 doi:10.1016/j.palaeo.2016.10.038

Sletten HR, Gillikin DP, Halfar J, Andrus CFT, Guzmán HM (2017b) Skeletal growth controls on Mg/Ca and P/Ca ratios in tropical eastern pacific rhodoliths (coralline red algae). Chem Geol 465:1–10 doi:10.1016/j.chemgeo.2017.05.010

Smale DA, Wernberg T, Vance T (2011) Community development on subtidal temperate reefs: the influences of wave energy and the stochastic recruitment of a dominant kelp. Mar Biol 158:1757–1766 doi:10.1007/s00227-011-1689-4

Smith AM, Sutherland JE, Kregting L, Farr TJ, Winter DJ (2012) Phylomineralogy of the coralline red algae: Correlation of skeletal mineralogy with molecular phylogeny. Phytochemistry 81:97–108 PubMed doi:10.1016/j.phytochem.2012.06.003

Sneed JM, Ritson-Williams R, Paul VJ (2015) Crustose coralline algal species host distinct bacterial assemblages on their surfaces. ISME J 9:2527–2536 PubMed doi:10.1038/ismej.2015.67

Sonnenholzner JI, Montaño-Moctezuma G, Searcy-Bernal R, Salas-Garza A (2011) Effect of macrophyte diet and initial size on the survival and somatic growth of sub-adult Strongylocentrotus purpuratus: a laboratory experimental approach. J Appl Phycol 23:505–513 doi:10.1007/s10811-010-9619-2

Sordo L, Santos R, Reis J, Shulika A, Silva J (2016) A direct CO_2 control system for ocean acidification experiments: testing effects on the coralline red algae *Phymatolithon lusitanicum.* PeerJ 4:e2503 PubMed doi:10.7717/peerj.2503

Sordo L, Santos R, Barrote I, Silva J (2018) High CO_2 decreases the long-term resilience of the free-living coralline algae *Phymatolithon lusitanicum.* Ecol Evol 8:4781–4792 PubMed doi:10.1002/ece3.4020

Sordo L, Santos R, Barrote I, Silva J (2019) Temperature amplifies the effect of high CO2 on the photosynthesis, respiration, and calcification of the coralline algae *Phymatolithon lusitanicum.* Ecol Evol 9:11000–11009 PubMed doi:10.1002/ece3.5560

Spotorno-Oliveira P, Figueiredo MAO, Tamega FTS (2015) Coralline algae inhance the settlement of the vermetid gastropod *Dendropoma irregulare* (d'Orbigny, 1842) in the

southwestern Atlantic. J Exp Mar Biol Ecol 471:137–145 doi:10.1016/j.jembe.2015.05.021

Stepien CC, Pfister CA, Wootton JT (2016) Functional traits for carbon access in macrophytes. PLoS One 11:e0159062 PubMed doi:10.1371/journal.pone.0159062

Stout EP, Prudhomme J, Le Roch K, Fairchild CR and others (2010) Unusual antimalarial meroditerpenes from tropical red macroalgae. Bioorg Med Chem Lett 20:5662–5665 PubMed doi:10.1016/j.bmcl.2010.08.031

Swanson RL, Byrne M, Prowse TAA, Mos B, Dworjanyn SA, Steinberg PD (2012) Dissolved histamine: A potential habitat marker promoting settlement and metamorphosis in sea urchin larvae. Mar Biol 159:915–925 doi:10.1007/s00227-011-1869-2

Tait LW (2014) Impacts of natural and manipulated variaitons in temperature, pH and light on photosynthetic parameters of coralline-kelp assemblages. J Exp Mar Biol Ecol 454:1–8 doi:10.1016/j.jembe.2014.01.016

Tâmega FTS, Figueiredo MAO (2019) Colonization, Growth and Productivity of Crustose Coralline Algae in Sunlit Reefs in the Atlantic Southernmost Coral Reef. Front Mar Sci 6: 81 doi:10.3389/fmars.2019.00081

Tebben J, Motti CA, Siboni N, Tapiolas DM and others (2015) Chemical mediation of coral larval settlement by crustose coralline algae. Sci Rep 5:10803 PubMed doi:10.1038/srep10803

Teichert S, Woelkerling W, Ruggeberg A, Wisshak M and others (2012) Rhodolith beds (Corallinales, Rhodophyta) and their physical and biological environment at 80 degrees 31 ' N in Nordkappbukta (Nordaustlandet, Svalbard Archipelago, Norway). Phycologia 51:371–390 doi:10.2216/11-76.1

Terradas-Fernández MT, Zubcoff J, Esplá AR (2019) Early succession patterns in a Mediterranean vermetid reef. J Sea Res 152:101768 doi:10.1016/j.seares.2019.101768

Tompkins PA, Steller DL (2016) Living carbonate habitats in temperate California (USA) waters: distribution, growth, and disturbance of Santa Catalina Island rhodoliths. Mar Ecol Prog Ser 560:135–145 doi:10.3354/meps11919

Uribe RA, Ortiz M, Macaya EC, Pacheco AS (2015) Successional patterns of hard-bottom macrobenthic communities at kelp bed (*Lessonia trabeculata*) and barren ground sublittoral systems. J Exp Mar Biol Ecol 472:180–188 doi:10.1016/j.jembe.2015.08.002

Uthicke S, Pecorino D, Albright R, Negri AP and others (2013) Impacts of ocean acidification on early life-history stages and settlement of the coral-eating sea star *Acanthaster planci.* PLoS One 8:e82938 PubMed doi:10.1371/journal.pone.0082938

Vale NF, Amado-Filho GM, Braga JC, Brasileiro PS and others (2018) Structure and composition of rhodoliths from the Amazon River mouth, Brazil. J S Am Earth Sci 84:149–159 doi:10.1016/j.jsames.2018.03.014

Vanmari D, Maneveldt GW (2019) Mechanisms of interference and exploitation competition in a guild of encrusting algae along a South African rocky shore. Afr J Mar Sci 41:353–359 doi:10.2989/1814232X.2019.1666738

Vásquez-Elizondo RM, Enríquez S (2016) Coralline algal physiology is more adversely affected by elevated temperature than reduced pH. Sci Rep 6:19030 PubMed doi:10.1038/srep19030

Vasquez-Elizondo RM, Enriquez S (2017) Light absorption in coralline algae (rhodophyta): A morphological and functional approach to understanding species distribution in a coral reef lagoon. Front Mar Sci 4:17 doi:10.3389/fmars.2017.00297

Villaça R, Fonseca AC, Jensen VK, Knoppers B (2010) Species composition and distribution of macroalgae on Atol das Rocas, Brazil, SW Atlantic. Bot Mar 53:113–122 doi:10.1515/BOT.2010.013

Villas-Boas AB, Riosmena-Rodriguez R, de Oliveira Figueiredo MA (2014a) Community structure of rhodolith-forming beds on the central Brazilian continental shelf. Helgol Mar Res 68:27–35 doi:10.1007/s10152-013-0366-z

Villas-Bôas AB, Tâmega FTDS, Andrade M, Coutinho R, de Oliveira Figueiredo MA (2014b) Experimental effects of sediment burial and light attenuation on two coralline algae of a deep water rhodolith bed in Rio de Janeiro, Brazil. Cryptogam, Algol 35:67–77 doi:10.7872/crya.v35.iss1.2014.67

Waki T, Rolan E, Noseworthy RG, Kang HS, Choi KS (2017) A new species of the genus *Ammonicera* (Prosobranchia, Omalogyridae) in a coralline algae community from Jeju Island, off the south coast of Korea. Ocean Sci J 52:587–591 doi:10.1007/s12601-017-0053-0

Wallenstein FM, Couto RP, Torrão DF, Neto AI, Rodrigues AS, Wilkinson M (2013) Intertidal rocky shore seaweed communities subject to the influence of shallow water hydrothermal activity in São Miguel (Azores, Portugal). Helgol Mar Res 67:535 doi:10.1007/s10152-012-0341-0

Walsh PJ, Walker GM, Maggs CA, Buchanan FJ (2010) Thermal prepartion of highly porous calcium phosphate bone filler derived from marine algae. J Mater Sci Mater Med 21:2281–2286 PubMed doi:10.1007/s10856-010-4056-y

Webster NS, Soo R, Cobb R, Negri AP (2011) Elevated seawater temperature causes a microbial shift on crustose coralline algae with implications for the recruitment of coral larvae. ISME J 5:759 PubMed doi:10.1038/ismej.2010.152

Webster NS, Uthicke S, Botté ES, Flores F, Negri AP (2013) Ocean acidification reduces induction of coral settlement by crustose coralline algae. Glob Change Biol 19:303–315 PubMed doi:10.1111/gcb.12008

Webster NS, Negri AP, Botté ES, Laffy PW and others (2016) Host-associated coral reef microbes respond to the cumulative pressures of ocean warming and ocean acidification. Sci Rep 6:19324 PubMed doi:10.1038/srep19324

Whalan S, Webster NS, Negri AP (2012) Crustose Coralline Algae and a Cnidarian Neuropeptide Trigger Larval Settlement in Two Coral Reef Sponges. PLoS One 7: e30386 PubMed doi:10.1371/journal.pone.0030386

Williams S, Adey W, Halfar J, Kronz A, Gagnon P, Bélanger D, Nash M (2018a) Effects of light and temperature on Mg uptake, growth, and calcification in the proxy climate archive *Clathromorphum compactum.* Biogeosciences 15:5745–5759 doi:10.5194/bg-15-5745-2018

Williams S, Halfar J, Zack T, Hetzinger S and others (2018b) Coralline Algae Archive Fjord Surface Water Temperatures in Southwest Greenland. J Geophys Res Biogeosci 123:2617–2626 doi:10.1029/2018JG004385

Williams S, Halfar J, Zack T, Hetzinger S, Blicher M, Juul-Pedersen T (2018c) Comparison of climate signals obtained from encrusting and free-living rhodolith coralline algae. Chem Geol 476:418–428 doi:10.1016/j.chemgeo.2017.11.038

Williamson CJ, Najorka J, Perkins R, Yallop ML, Brodie J (2014) Skeletal mineralogy of geniculate corallines: providing context for climate change and ocean acidification research. Mar Ecol Prog Ser 513:71–84 doi:10.3354/meps10929

Wolf MA, Falace A, Kaleb S, Moro I (2016) Molecular data confirm the existence of attached crustose tetrasporangial thalli in *Phymatolithon calcareum* (Melobesioideae, Hapalidiaceae, Rhodophyta) from the Mediterranean Sea. Aquat Bot 134:75–81 doi:10.1016/j.aquabot.2016.07.006

Yiu DS, Feehan CJ (2017) Articulated coralline algae provide a spatial refuge to juvenile sea urchins from predatory crabs. Mar Biol 164:7 doi:10.1007/s00227-017-3108-y

Zweng RC, Koch MS, Bowes G (2018) The role of irradiance and C-use strategies in tropical macroalgae photosynthetic response to ocean acidification. Sci Rep 8:9479 PubMed doi:10.1038/s41598-018-27333-0