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Supplementary material

Appendix 1

Table A1. Survey of 42 studies investigating divergence of thermal phenotype in marine macrophytes. Abbreviations: Life Stage, Sp = Sporophyte, Gam = gametophyte, Mat = Mature seagrass, Experimental Design, CG-chr/CG-ac = Common Garden studies whereby temperature has been applied in either chronic (chr), acute (ac) or heatwave (HW) fashion, Trans = Transplant experiment. Response Variable, Gr = growth, Sv = Survival, HSR = Heat Shock Response (through quantification of heat shock proteins), Chl*a*-fl = chlorophyll a fluorometry.

Reference	Study Species	Life Stage	Regions tested	Geographic Scale (max distance)	Experimental Design	Response variable	Key Findings	Macrophyte Type
Anderson *et al*., (2013)	*Saccharina latissima*	sp	3	1200	CG-chr	Gr, Sv, Chla-fl	No difference	Brown
Bennett *et al*., (2015)	*Scytothalia dorycarpa*	sp	3	450	Trans	Gr, Sv, Rep	Central populations intolerant of edge conditions	Brown
Bergmann., *et al.,* (2010)	*Zostera marina*	Mat	5	6300	CG-HW	Gr, Sv, Gene exp	Similar growth reductions. Difference in recovery of gene expression.	Seagrass
Bischoff and Wiencke (1995)	*Urospora penicilliformis*	sp	5	5000	CG-chr	Gr, Sv	Warmer strains more thermotolerant	Green
Bolton, 1983	*Ectocarpus siliculosus*	SP	9	20000	CG-chr	Gr, Sv	Growth and upper survival temperature correlated with native site	Brown
Bruhn and Gerard (1996)	*Saccharina latissima*	sp	2	550	CG-chr F_1 pop	Chla-fl	Recovery greatest in warmer populations	Brown
Cambridge *et al*., (1987)	*Chladophora coelothrix,Chladophora laetevirens*	sp	4	3500	CG-chr	Gr	Cool populations of *C. coelothrix* more cold tolerant. No difference in C. laetevirens populations	Green
Ferrerai et al., (2014)	*Fucus spiralis,*	Sp	2	1366	CG-ac	Chla-fl	Warmer populations more thermotolerant	Brown
Flukes *et al*., (2015)	*Phyllospora comosa*	sp	2	500	CG-chr	Chla-fl	Warm populations more thermotolerant	Brown
Franssen *et al.,* (2011)	*Zostera marina*	Mat	5	6300	CG-HW	RNAseq	Transcriptome return to control levels faster in warmer populations ('Transcriptomic resilience')	Seagrass
Franssen *et al*., (2014)	*Zostera marina, Nanozostera noltii*	Mat	5	6300	CG-HW	RNAseq	Higher constitutive expression of heat responsive genes in warmer populations.	Seagrass
Gao *et al*., (2013a)	*Undaria pinitifida*	sp	3	1000	CG-chr	Gr, Sv	Warm populations more thermotolerant	Brown
Gao *et al*., (2013b)	*Undaria pinitifida*	sp	3	1000	Trans	GR, Sv, Phot, N_2 con	Warm F_3 generations grown in cool conditions still more thermotolerant	Brown
Gerard (1997)	*Saccharina latissima*	sp	2	500	CG-chr	Gr, Chla-fl N2 content	Warmer populations more thermotolerant attributed to capacity to store nitrogen	Brown
Gerard and Dubois (1988)	*Saccharina latissima*	sp	2	2800	CG-chr, Trans	Gr, Sv, Chla-fl	Central populations unable to survive edge conditions	Brown
Gerard *et al*., (1987)	*Saccharina latissima*	sp	2	500	CG-chr	Gr	Trailing edge populations more thermotolerant	Brown

Gu *et al*., (2012)	*Zostera marina, Zostera noltii*	Mat	5	6300	CG-HW	Gene exp, metabolomics, Gr	Warmer populations more thermotolerant	Seagrass
Henkel and Hofmann (2008)	*Egregia menziesii,*	SP	6	720	CG-ac	HSR	Warmer populations more thermotolerant	Brown
Jueterbock *et al.,* (2014)	*Fucus vesiculosus*	Sp	4	4153	CG-ac	HSR Chla-fl	Trailing edge populations more thermotolerant than range centre populations	Brown
Jueterbock *et al*., (2016)	*Zostera marina*	Mat	5	6300	CG-HW	RNAseq	Warmer population show greater transcriptomic resilience	Seagrass
Kain (1969)	*Laminaria hyperborea*	sp	2	1300	CG-chr	Sv	Warmer populations more thermotolerant	Brown
King *et al*., (2016)	*Laminaria digitata*	sp	2	5500	CG-ac	HSR	Warmer populations more thermotolerant	Brown
Ladah and Zertche-Gonzalez (2007)	*Macrocystis pyrifera*	Em-sp	2	2300	CG-chr	Gr, Sv	Warmer populations more thermotolerant	Brown
Liu and Pang (2010)	*Saccharina japonica*	sp	2	465	CG-chr F1 pop	Gr, Chla-fl	Warmer populations more thermotolerant	Brown
Luning (1975)	*Saccharina latissima*	Sp + Gam	2	570	CG-chr	Gr, Sv	Warm populations more thermotolerant	Brown
Martínez (1999)	*Lessonia nigrescens*	Em-Sp	2	920	CG-chr	Gr, Sv	Warmer populations more thermotolerant	Brown
Martínez *et al*., (2012)	*Fucus serratus*	sp	2	350	CG-ac	Gr Chla-fl	No difference	Brown
Mohring *et al*. (2014)	*Ecklonia radiata*	Gam	3	3100	CG-chr	Sv, Gr	Growth and survival reflective of site of origin	Brown
Muller *et al* (2008)	*Saccharina latissima, Laminaria digitata*	Gam	2	500	Crossing Exp	Germination	Germination inhibited at cooler temperatures in Arctic population. Thermal characteristics shown to have genetic basis through crossing experiment	Brown
Novaczek (1984)	*Ecklonia radiata*	Gam	2	1000	CG-chr	Gr, Rp	Warm population more tolerant of summer temperatures	Brown
Novaczek and Breeman (1990)	*Furcellaria lumbricalis, Polyides rotundus*	sp	2	5800	CG-chr	Gr, Sv	No difference in *Furcellaria lumbricalis*. Warmer *Polyides rotundus* populations more thermotolerant	Brown
Novaczek *et al*., 1989	*Stypocaulon scoparium*	sp	5	4000	CG-chr	Gr, Sv	Warm populations more thermotolerant. Cool populations more cold tolerant.	Brown
Pakker *et al.,* (1996)	*Digenea simplex*	sp	4	3000	CG-chr	Gr, Sv	No difference	Red
Pearson *et al*., (2009)	*Fucus serratus, Fucus vesiculosus*	sp	2	1120	CG-ac	HSR Chla-fl	Trailing edge *F. serratus populations* maladapted to edge conditions. However, No differentiation in F. vesiculosus (non-edge control)	Brown
Pereira et al., (2015)	*Laminaria ochroleuca, Sachariza polyschides*	sp	2	1200	CG-chr + ac	Gr, Chla-fl	*L. ochroleuca* warmer populations more thermotolerant. S. polyschides no difference	Brown

Saada *et al*., (2016)	*Fucus vesiculosus*	sp	2	420	CG-ac, Trans	Gr Chla-fl	Warmer populations more thermotolerant. Clear genotype-by-environment interactions	Brown
Serisawa et al 2004	*Ecklonia cava*	Sp	2	530	Trans	Phot/Res	Warm population more tolerant of summer temperatures	Brown
Smolina et al 2016	*Fucus disticus*	Sp	2	1250	CG-ac	HSR, Chla-fl	Warmer populations more thermotolerant	Brown
Staehr and Wernberg (2009)	*Ecklonia. radiata*	Sp	4	750	CG-ac	Phot/ Res	Warmer populations more tolerant of supra-optimal temperatures	Brown
Wernberg *et al*., (2016)	*Ecklonia radiata, Scytothalia dorycarpa, Sargassum fallax*	Sp	4	750	CG-ac	Phot/Res	Warmer populations more tolerant of supra-optimal temperatures	Brown
Winters *et al*., (2011)	*Zostera marina*	Mat	5	6300	CG-HW	Gene exp, Chla-fl	Similar stress during heatwave. Warmer populations showed better recovery.	Seagrass
Zardi *et al*., (2013)	*Fucus vesiculosus*	sp	2	1100	CG-ac	Chla-fl	No difference	Brown

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