

Assessing the consequences of environmental impacts: variation in species responses has unpredictable functional effects

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Structure of Minimum Adequate Models

Summary of the statistical analyses of the 8 mixed effects models. For each model the initial and final mixed effects models are listed with a comparison of the standardised residuals versus fitted values and a summary of the coefficient table where appropriate.

The following abbreviations are used for species identities:

Ctrl = no macrofauna, *Af* = *Amphiura filiformis*, *Al* = *Anapagurus laevis*, *Ap* = *Aporrhais pespelecani*, *Cg* = *Chamelea gallina*, *Nh* = *Nucula hanleyi*, *Ss* = *Sternaspis scutata*, *Tc* = *Turritella communis*

Model S1: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity and pH) for the effects of species identity and pH on maximum luminophore depth (Lum_{max}) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $Lum_{max} \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $Lum_{max} \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$,

weights = `varIdent(form=~1|as.factor(species identity)*as.factor(pH))`,

method= "REML"

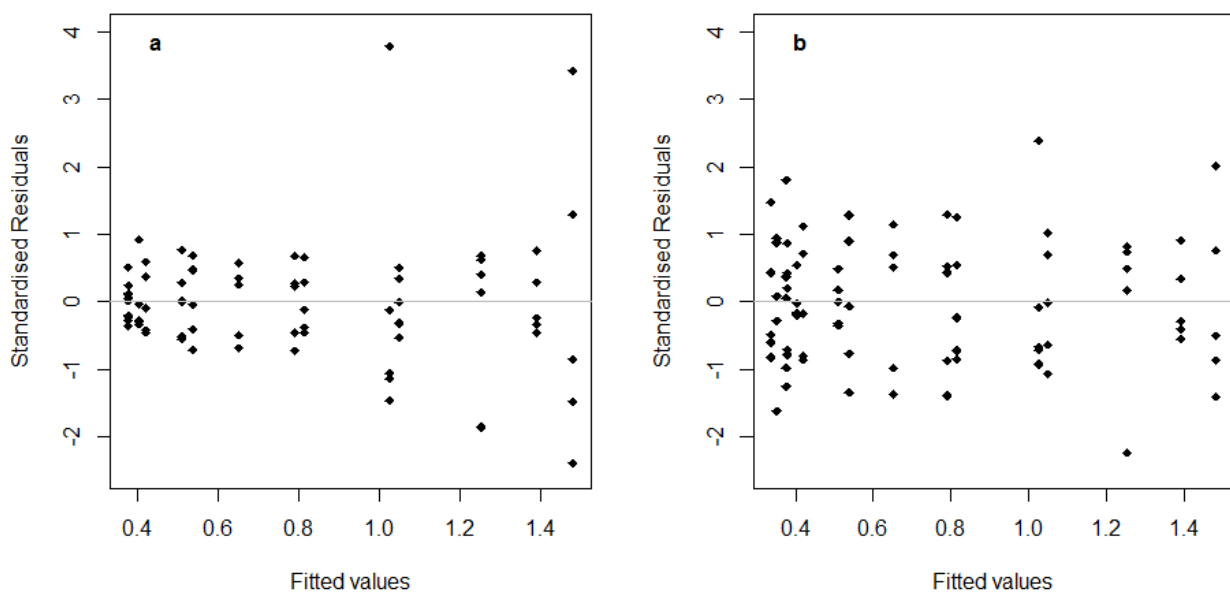


Figure S1: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S1: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Full model	13	63.281	54.454	<0.0001
Interaction	6	67.596	16.316	0.012
Species identity	12	93.726	54.446	<0.0001
pH	7	65.864	16.583	0.020

Table S2: Coefficient table for Model S1 at pH ~ 8.1. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Af	Al	Ap	Cg	Nh	Ss
Al	-1.305 \pm 0.482 -2.706 (0.009)	-	-	-	-	-
Ap	-0.717 \pm 0.492 -1.458 (0.151)	0.588 \pm 0.120 4.902 ($<$ 0.000)	-	-	-	-
Cg	-1.152 \pm 0.481 -2.392 (0.021)	0.153 \pm 0.057 2.706 (0.009)	-0.434 \pm 0.116 -3.742 (0.001)	-	-	-
Nh	-0.442 \pm 0.487 -0.908 (0.368)	0.863 \pm 0.100 8.602 ($<$ 0.000)	0.275 \pm 0.123 2.238 (0.030)	0.710 \pm 0.094 7.584 ($<$ 0.000)	-	-
Ss	-0.293 \pm 0.548 -0.534 (0.612)	1.012 \pm 0.268 3.774 (0.009)	0.424 \pm 0.281 1.507 (0.182)	0.859 \pm 0.268 3.206 (0.019)	0.149 \pm 0.276 0.541 (0.608)	-
Tc	-0.502 \pm 0.663 -0.757 (0.453)	0.803 \pm 0.460 1.745 (0.087)	0.215 \pm 0.466 0.462 (0.646)	0.650 \pm 0.460 1.414 (0.164)	-0.060 \pm 0.464 -0.129 (0.898)	0.209 \pm 0.527 -0.396 (0.694)

Table S3: Coefficient table for Model S1 at pH ~ 6.5. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Af	Al	Ap	Cg	Nh	Ss
Al	-0.155 \pm 0.134 -1.156 (0.253)	-	-	-	-	-
Ap	0.455 \pm 0.167 2.726 (0.009)	0.670 \pm 0.191 3.196 (0.002)	-	-	-	-
Cg	0.165 \pm 0.179 0.922 (0.361)	0.319 \pm 0.201 1.589 (0.118)	-0.291 \pm 0.214 -1.359 (0.180)	-	-	-
Nh	0.306 \pm 0.149 2.060 (0.045)	0.461 \pm 0.175 2.631 (0.011)	-0.149 \pm 0.189 -0.790 (0.434)	0.141 \pm 0.195 0.724 (0.473)	-	-
Ss	0.998 \pm 0.193 5.183 (0.002)	1.153 \pm 0.212 5.436 (0.002)	0.543 \pm 0.228 2.375 (0.055)	0.833 \pm 0.234 3.555 (0.012)	0.692 \pm 0.215 3.224 (0.018)	-
Tc	0.181 \pm 0.138 1.312 (0.196)	0.336 \pm 0.166 2.028 (0.048)	-0.274 \pm 0.186 -1.475 (0.147)	0.016 \pm 0.198 0.083 (0.934)	-0.125 \pm 0.170 -0.733 (0.467)	-0.817 \pm 0.212 -3.861 ($<$ 0.000)

Model S2: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity) for the effects of species identity and pH on mean maximum luminophore depth (Lum_{mean}) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $Lum_{mean} \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $Lum_{mean} \sim \text{species identity} + \text{random} = \text{run}$,

weights = varIdent(form= ~ 1 |as.factor(species identity)),

method= "REML"

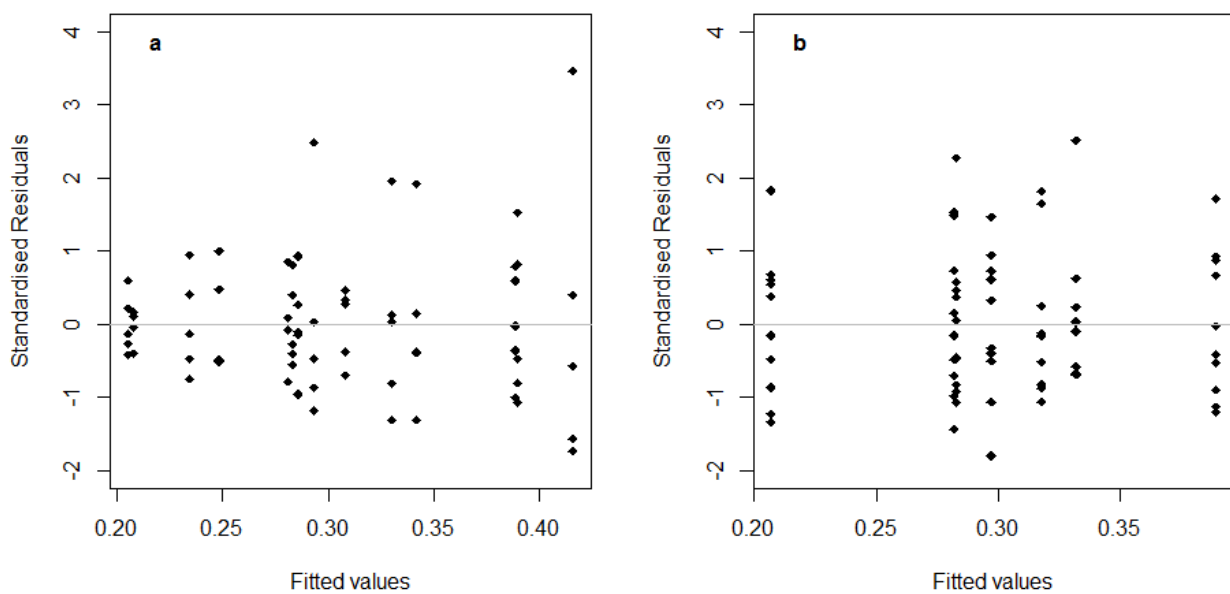


Figure S2: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S4: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Species identity	6	-94.240	18.201	0.006

Table S5: Coefficient table for Model S2. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Af	Al	Ap	Cg	Nh	Ss
Al	-0.125 \pm 0.070 -1.785 (0.080)	-	-	-	-	-
Ap	-0.014 \pm 0.087 -0.162 (0.872)	0.111 \pm 0.055 1.998 (0.051)	-	-	-	-
Cg	-0.049 \pm 0.081 -0.606 (0.547)	0.076 \pm 0.045 1.678 (0.099)	-0.035 \pm 0.069 -0.509 (0.613)	-	-	-
Nh	-0.035 \pm 0.073 -0.476 (0.636)	0.090 \pm 0.028 3.226 (0.002)	-0.021 \pm 0.059 -0.350 (0.728)	0.014 \pm 0.049 0.292 (0.771)	-	-
Ss	0.057 \pm 0.078 0.730 (0.493)	0.182 \pm 0.040 4.522 (0.004)	0.071 \pm 0.066 1.085 (0.319)	0.106 \pm 0.057 1.854 (0.113)	0.092 \pm 0.045 2.043 (0.087)	-
Tc	-0.050 \pm 0.072 -0.688 (0.494)	0.075 \pm 0.027 2.787 (0.007)	-0.036 \pm 0.058 -0.611 (0.543)	-0.001 \pm 0.049 -0.015 (0.988)	-0.015 \pm 0.034 -0.452 (0.653)	-0.107 \pm 0.044 -2.411 (0.019)

Model S3: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity) for the effects of species identity on median maximum luminophore depth (Lum_{med}) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $Lum_{med} \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $Lum_{med} \sim \text{species identity} + \text{random} = \text{run}$,

weights = `varIdent(form=~1|as.factor(species identity))`,

method= "REML"

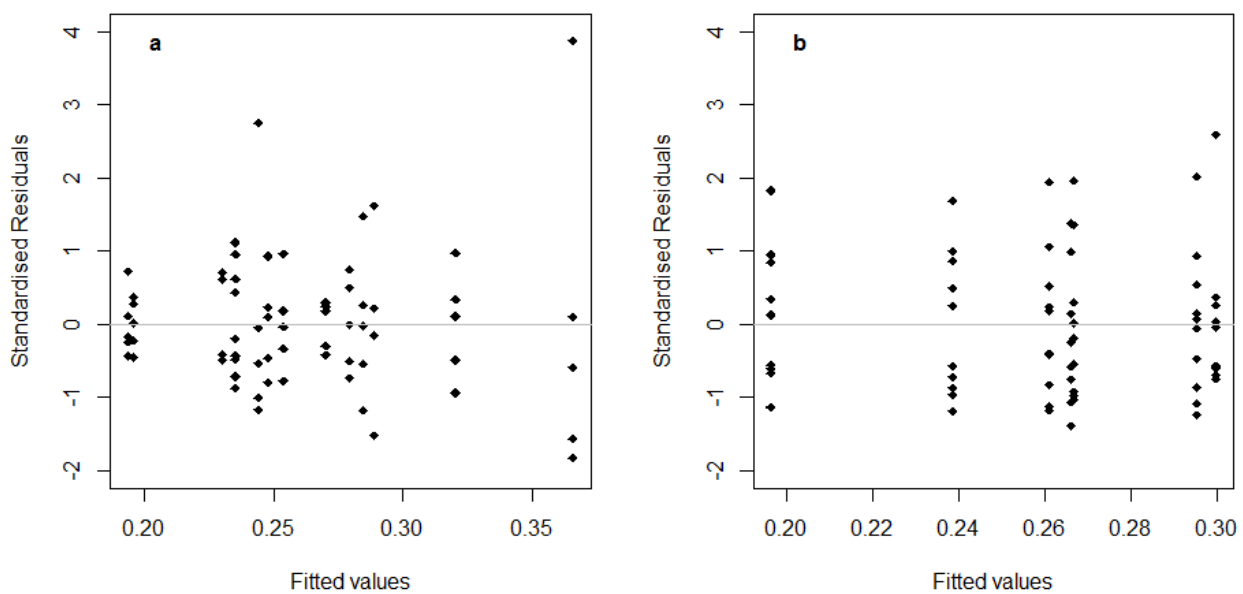


Figure S3: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S6: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Species identity	6	-111.805	13.043	0.042

Table S7: Coefficient table for Model S3. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Af	Al	Ap	Cg	Nh	Ss
Al	-0.103 \pm 0.067 -1.537 (0.130)	-	-	-	-	-
Ap	-0.033 \pm 0.083 -0.398 (0.692)	0.070 \pm 0.053 1.329 (0.189)	-	-	-	-
Cg	-0.039 \pm 0.074 -0.525 (0.601)	0.065 \pm 0.037 1.744 (0.087)	-0.006 \pm 0.061 -0.195 (0.925)	-	-	-
Nh	-0.034 \pm 0.070 -0.484 (0.630)	0.070 \pm 0.028 2.500 (0.015)	-0.001 \pm 0.055 -0.011 (0.991)	0.005 \pm 0.041 0.127 (0.900)	-	-
Ss	-0.004 \pm 0.070 -0.064 (0.951)	0.099 \pm 0.029 3.420 (0.014)	0.029 \pm 0.056 0.508 (0.629)	0.034 \pm 0.042 0.823 (0.442)	0.029 \pm 0.034 0.870 (0.418)	-
Tc	-0.061 \pm 0.069 -0.881 (0.382)	0.042 \pm 0.028 1.528 (0.132)	-0.028 \pm 0.055 -0.508 (0.613)	-0.022 \pm 0.041 -0.548 (0.586)	-0.028 \pm 0.032 -0.853 (0.397)	-0.057 \pm 0.034 -1.690 (0.097)

Model S4: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity and pH) for the effects of species identity on rugosity of the lower extent of the mixed layer (Lum_{rug}) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $Lum_{rug} \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $Lum_{rug} \sim \text{species identity} + \text{random} = \text{run}$,

weights = varIdent(form= ~ 1 |as.factor(species identity)*as.factor(pH)),

method= "REML"

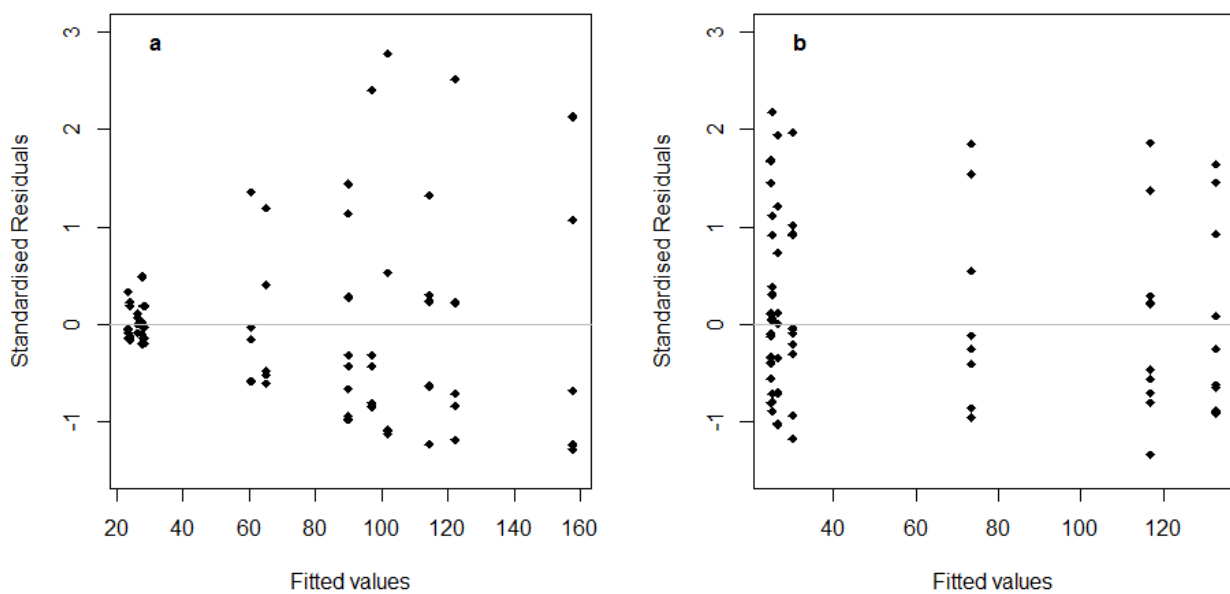


Figure S4: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S8: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Species identity	6	773.916	17.75258	0.0069

Table S9: Coefficient table for Model S4. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Af	Al	Ap	Cg	Nh	Ss
Al	1.327 \pm 7.449 0.178 (0.859)	-	-	-	-	-
Ap	91.678 \pm 28.693 3.195 (0.002)	90.351 \pm 28.034 3.223 (0.002)	-	-	-	-
Cg	-0.374 \pm 9.580 -0.039 (0.969)	-1.701 \pm 7.372 -0.231 (0.818)	-92.051 \pm 28.673 -3.210 (0.002)	-	-	-
Nh	48.297 \pm 22.007 2.194 (0.032)	46.970 \pm 21.139 2.222 (0.030)	-43.381 \pm 34.852 -1.245 (0.218)	48.671 \pm 21.981 2.214 (0.031)	-	-
Ss	107.565 \pm 40.102 2.682 (0.036)	106.239 \pm 39.633 2.681 (0.037)	15.888 \pm 48.359 0.329 (0.754)	107.939 \pm 40.088 2.693 (0.036)	59.268 \pm 44.717 1.325 (0.233)	-
Tc	4.892 \pm 9.315 0.525 (0.602)	3.565 \pm 7.023 0.508 (0.614)	-86.786 \pm 28.586 -3.036 (0.004)	5.265 \pm 9.252 0.569 (0.572)	-43.405 \pm 21.866 -1.985 (0.052)	-102.674 \pm 40.025 -2.565 (0.013)

Model S5: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity and pH) for the effects of species identity and seawater acidification on the change in ammonium concentration ($\Delta[\text{NH}_4\text{-N}]$) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $\Delta[\text{NH}_4\text{-N}] \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $\Delta[\text{NH}_4\text{-N}] \sim \text{species identity} + \text{pH} + \text{random} = \text{run}$,
 weights = varIdent(form= ~ 1 |as.factor(species identity)),
 method= "REML"

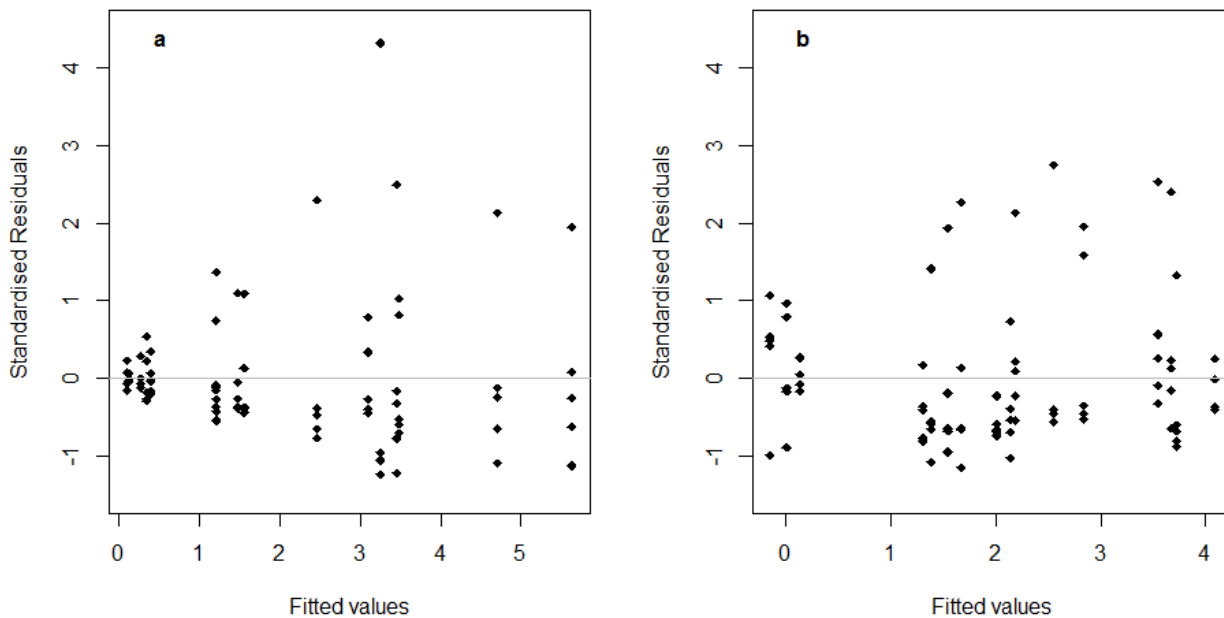


Figure S5: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S10: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Full model	8	389.173	31.255	<0.0001
Species identity	7	403.271	17.289	0.016
pH	1	388.824	16.905	<0.0001

Table S11: Coefficient table for Model S5. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Ctrl	Af	Al	Ap	Cg	Nh	Ss
Af	1.453 \pm 0.656 2.216 (0.030)	-	-	-	-	-	-
Al	0.286 \pm 0.587 0.487 (0.628)	-1.167 \pm 0.753 -1.550 (0.126)	-	-	-	-	-
Ap	2.285 \pm 0.985 2.319 (0.024)	0.832 \pm 1.117 0.745 (0.459)	1.999 \pm 1.098 1.820 (0.073)	-	-	-	-
Cg	2.159 \pm 0.973 2.218 (0.030)	0.706 \pm 1.098 0.643 (0.523)	1.873 \pm 1.059 1.769 (0.082)	-0.126 \pm 1.325 -0.095 (0.925)	-	-	-
Nh	0.159 \pm 0.484 0.330 (0.743)	-1.293 \pm 0.702 -1.843 (0.070)	-0.126 \pm 0.680 -0.186 (0.853)	-2.125 \pm 1.017 -2.090 (0.041)	-1.999 \pm 1.003 -1.993 (0.051)	-	-
Ss	2.336 \pm 1.394 1.676 (0.145)	0.883 \pm 1.480 0.597 (0.573)	2.050 \pm 1.452 1.412 (0.208)	0.051 \pm 1.661 0.031 (0.977)	0.177 \pm 1.650 0.107 (0.918)	2.176 \pm 1.419 1.533 (0.176)	-
Tc	2.698 \pm 1.515 1.780 (0.080)	1.245 \pm 1.591 0.782 (0.437)	2.412 \pm 1.577 1.529 (0.131)	0.413 \pm 1.762 0.234 (0.816)	0.539 \pm 1.757 0.307 (0.760)	2.538 \pm 1.538 1.650 (0.104)	0.362 \pm 2.018 0.179 (0.858)

Model S6: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity and pH) for the effects of species identity and seawater acidification on the change in combined nitrate and nitrite concentration ($\Delta[\text{NO}_x\text{-N}]$) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $\Delta[\text{NO}_x\text{-N}] \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $\Delta[\text{NO}_x\text{-N}] \sim \text{species identity} * \text{pH} + \text{random} = \text{run, method= "REML"}$

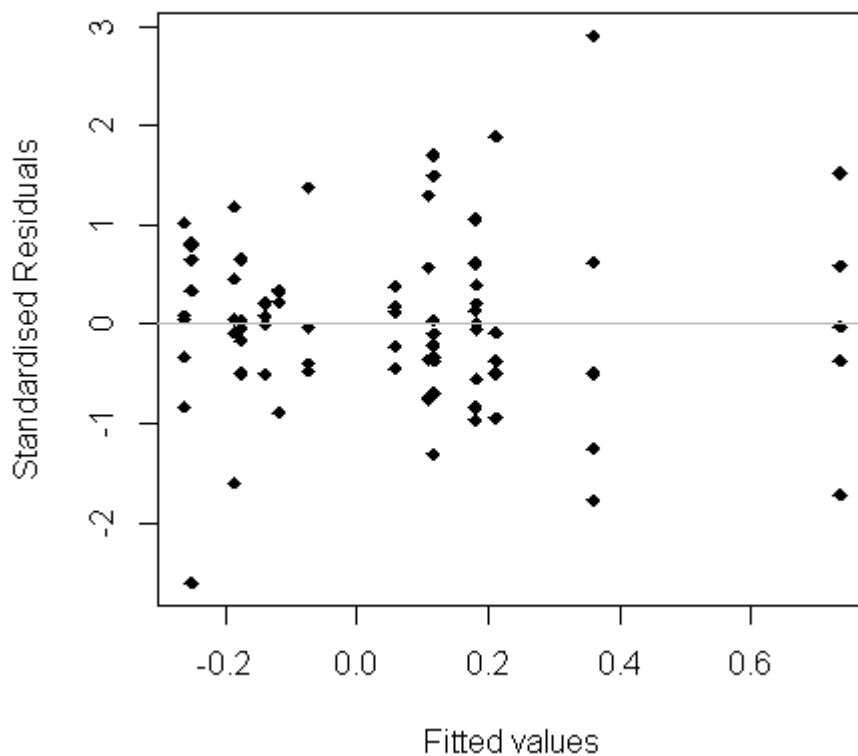


Figure S6: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S12: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Full model	15	104.136	28.310	0.019
Interaction	7	107.782	15.957	0.026
Species identity	7	106.074	12.292	0.091
pH	1	105.851	0.069	0.793

Table S13: Coefficient table for Model S6 at pH ~ 8.1. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Ctrl	Af	Al	Ap	Cg	Nh	Ss
Af	0.432 \pm 0.253 1.708 (0.093)	-	-	-	-	-	-
Al	0.133 \pm 0.289 0.458 (0.649)	-0.299 \pm 0.290 -1.032 (0.307)	-	-	-	-	-
Ap	0.433 \pm 0.256 1.694 (0.096)	0.001 \pm 0.267 0.004 (0.997)	0.301 \pm 0.300 1.000 (0.322)	-	-	-	-
Cg	0.368 \pm 0.258 1.428 (0.159)	-0.064 \pm 0.255 -0.249 (0.804)	0.236 \pm 0.274 0.861 (0.393)	-0.065 \pm 0.268 -0.242 (0.810)	-	-	-
Nh	0.367 \pm 0.252 1.455 (0.151)	-0.065 \pm 0.256 -0.252 (0.802)	0.235 \pm 0.297 0.792 (0.432)	-0.066 \pm 0.255 -0.258 (0.798)	-0.001 \pm 0.260 -0.003 (0.997)	-	-
Ss	-0.011 \pm 0.347 -0.032 (0.975)	-0.443 \pm 0.349 -1.272 (0.251)	-0.144 \pm 0.370 -0.389 (0.711)	-0.444 \pm 0.351 -1.265 (0.253)	-0.380 \pm 0.349 -1.089 (0.318)	-0.379 \pm 0.349 -1.086 (0.319)	-
Tc	0.612 \pm 0.252 2.427 (0.018)	0.180 \pm 0.257 0.699 (0.488)	0.479 \pm 0.291 1.646 (0.105)	0.179 \pm 0.256 0.699 (0.488)	0.243 \pm 0.260 0.936 (0.353)	0.244 \pm 0.259 0.944 (0.349)	0.623 \pm 0.348 1.789 (0.079)

Table S14: Coefficient table for Model S6 at pH ~ 6.5. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Ctrl	Af	Al	Ap	Cg	Nh	Ss
Af	-0.133 \pm 0.264 -0.505 (0.615)	-	-	-	-	-	-
Al	0.153 \pm 0.270 0.564 (0.575)	0.286 \pm 0.256 1.114 (0.270)	-	-	-	-	-
Ap	0.677 \pm 0.255 2.651 (0.010)	0.810 \pm 0.262 3.097 (0.003)	0.524 \pm 0.278 1.885 (0.065)	-	-	-	-
Cg	0.050 \pm 0.257 0.194 (0.847)	0.183 \pm 0.272 0.673 (0.504)	-0.103 \pm 0.286 -0.359 (0.721)	-0.627 \pm 0.265 -2.369 (0.021)	-	-	-
Nh	-0.245 \pm 0.253 -0.971 (0.336)	-0.112 \pm 0.260 -0.431 (0.668)	-0.398 \pm 0.277 -1.436 (0.156)	-0.922 \pm 0.250 -3.686 (0.001)	-0.295 \pm 0.255 -1.157 (0.252)	-	-
Ss	-0.235 \pm 0.348 -0.675 (0.525)	-0.102 \pm 0.349 -0.293 (0.780)	-0.388 \pm 0.357 -1.087 (0.319)	-0.912 \pm 0.349 -2.617 (0.040)	-0.285 \pm 0.353 -0.808 (0.450)	0.010 \pm 0.347 0.029 (0.978)	-
Tc	-0.198 \pm 0.263 -0.755 (0.454)	-0.065 \pm 0.254 -0.256 (0.799)	-0.351 \pm 0.271 -1.293 (0.201)	-0.875 \pm 0.253 -3.462 (0.001)	-0.248 \pm 0.269 -0.922 (0.361)	0.047 \pm 0.254 0.187 (0.853)	0.037 \pm 0.349 0.107 (0.915)

Model S7: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity and pH) for the effects of species identity and seawater acidification on the change in phosphate concentration ($\Delta[\text{PO}_4\text{-P}]$) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $\Delta[\text{PO}_4\text{-P}] \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $\Delta[\text{PO}_4\text{-P}] \sim \text{species identity} + \text{pH} + \text{random} = \text{run}$,
 weights = varIdent(form= ~ 1 |as.factor(species identity)),
 method= "REML"

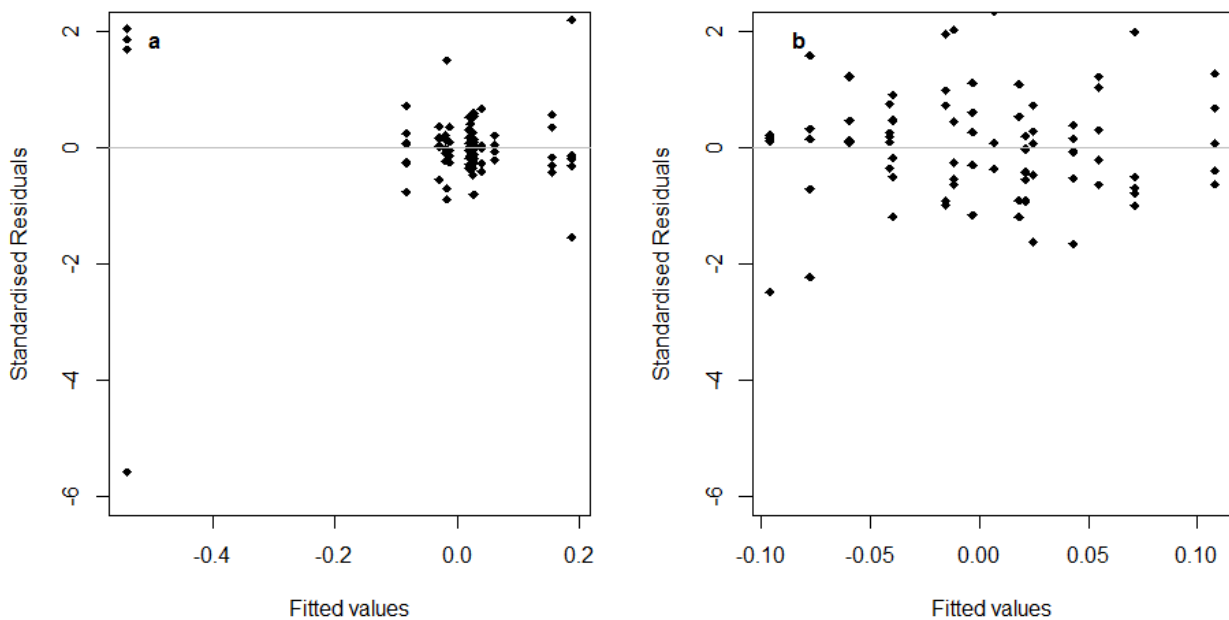


Figure S7: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S15: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Full model	8	-152.514	28.850	<0.0001
Species identity	7	-155.494	23.871	0.001
pH	1	-156.917	10.447	0.001

Table S16: Coefficient table for Model S7. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Ctrl	Af	Al	Ap	Cg	Nh	Ss
Af	0.024 \pm 0.017 1.459 (0.149)	-	-	-	-	-	-
Al	-0.056 \pm 0.241 -0.234 (0.816)	-0.081 \pm 0.241 -0.335 (0.739)	-	-	-	-	-
Ap	0.058 \pm 0.013 4.489 ($<$ 0.000)	0.034 \pm 0.019 1.738 (0.087)	0.114 \pm 0.241 0.475 (0.637)	-	-	-	-
Cg	0.111 \pm 0.042 2.652 (0.010)	0.087 \pm 0.044 1.962 (0.054)	0.168 \pm 0.244 0.686 (0.495)	0.053 \pm 0.043 1.236 (0.221)	-	-	-
Nh	-0.038 \pm 0.030 -1.268 (0.209)	-0.062 \pm 0.033 -1.879 (0.065)	0.018 \pm 0.243 0.076 (0.940)	-0.096 \pm 0.031 -3.052 (0.003)	-0.149 \pm 0.051 -2.938 (0.005)	-	-
Ss	0.046 \pm 0.026 1.774 (0.126)	0.022 \pm 0.030 0.746 (0.484)	0.103 \pm 0.242 0.425 (0.686)	-0.012 \pm 0.028 -0.415 (0.693)	-0.065 \pm 0.049 -1.332 (0.231)	0.084 \pm 0.039 2.170 (0.073)	-
Tc	0.028 \pm 0.017 1.658 (0.102)	0.004 \pm 0.022 0.170 (0.866)	0.084 \pm 0.241 0.350 (0.728)	-0.030 \pm 0.019 -1.545 (0.127)	-0.083 \pm 0.044 -1.873 (0.066)	0.066 \pm 0.033 1.981 (0.052)	-0.018 \pm 0.030 -0.617 (0.540)

Model S8: Form of initial mixed effects model and the final model with variance covariate structure (incorporating species identity and pH) for the effects of species identity and seawater acidification on changes in silicate concentration ($\Delta[\text{SiO}_2\text{-Si}]$) fitted using restricted maximum likelihood estimation.

Initial model:

(a) $\Delta[\text{SiO}_2\text{-Si}] \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$

Final model:

(b) $\Delta[\text{SiO}_2\text{-Si}] \sim \text{species identity} * \text{pH} + \text{random} = \text{run}$,
 weights = varIdent(form= ~ 1 |as.factor(species identity)),
 method= "REML"

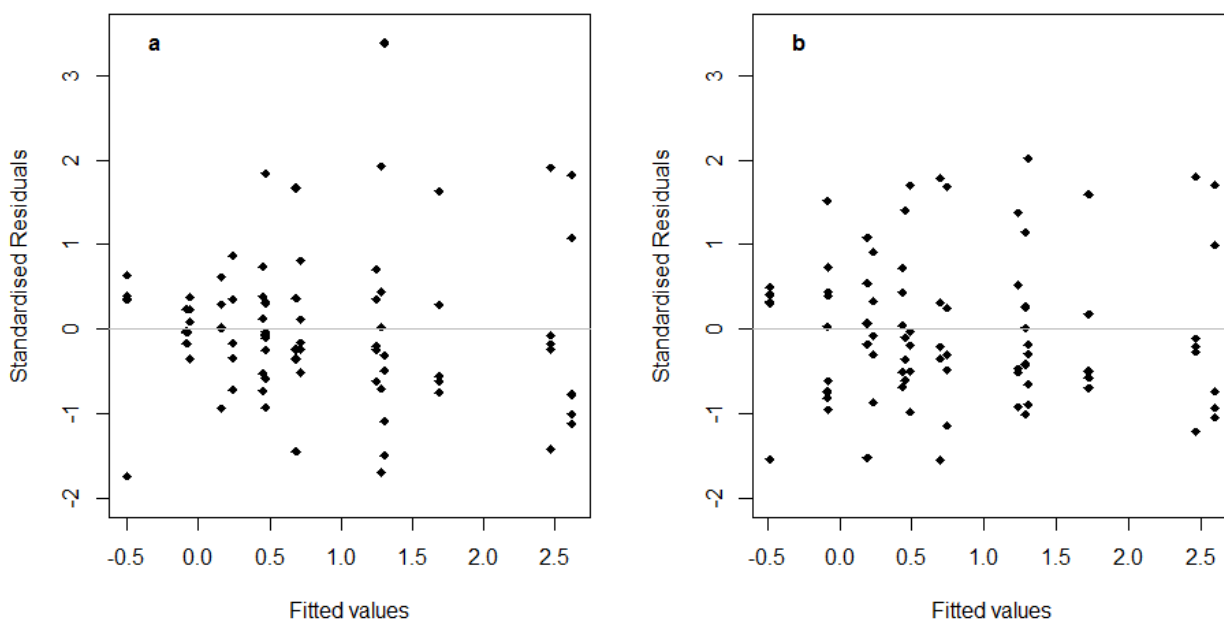


Figure S8: Standardized residuals versus fitted values the initial mixed effects model (a) and the minimum adequate model (b).

Table S17: Model summary table. Values were obtained by removing the term in column 1 and any interaction containing that term, then comparing the reduced model with the full model using a likelihood ratio test. Full model values are based on likelihood ratio test with an intercept model.

<i>Term Removed</i>	<i>d.f.</i>	<i>AIC</i>	<i>L Ratio</i>	<i>p-value</i>
Full model	15	243.086	69.969	<0.0001
Interaction	7	209.258	20.142	0.005
Species identity	7	216.487	21.228	0.003
pH	1	242.054	34.795	<0.0001

Table S18: Coefficient table for Model S8 at pH ~ 8.1. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Ctrl	Af	Al	Ap	Cg	Nh	Ss
Af	0.510 \pm 0.573 0.890 (0.377)	-	-	-	-	-	-
Al	-0.023 \pm 0.633 -0.037 (0.971)	-0.533 \pm 0.635 -0.839 (0.405)	-	-	-	-	-
Ap	0.532 \pm 0.577 0.922 (0.360)	0.022 \pm 0.591 0.037 (0.971)	0.555 \pm 0.646 0.859 (0.394)	-	-	-	-
Cg	-0.444 \pm 0.580 -0.766 (0.447)	-0.954 \pm 0.577 -1.654 (0.104)	-0.421 \pm 0.614 -0.685 (0.496)	-0.976 \pm 0.592 -1.648 (0.105)	-	-	-
Nh	0.302 \pm 0.573 0.527 (0.600)	-0.208 \pm 0.577 -0.361 (0.720)	0.325 \pm 0.642 0.506 (0.615)	-0.230 \pm 0.576 -0.399 (0.691)	0.746 \pm 0.581 1.283 (0.205)	-	-
Ss	1.344 \pm 0.646 2.080 (0.083)	0.834 \pm 0.649 1.284 (0.246)	1.367 \pm 0.694 1.969 (0.097)	0.812 \pm 0.653 1.243 (0.260)	1.788 \pm 0.649 2.753 (0.033)	1.042 \pm 0.649 1.605 (0.160)	-
Tc	0.220 \pm 0.572 0.384 (0.703)	-0.290 \pm 0.579 -0.501 (0.618)	0.243 \pm 0.636 0.382 (0.704)	-0.312 \pm 0.577 -0.541 (0.590)	0.664 \pm 0.583 1.138 (0.260)	-0.082 \pm 0.582 -0.141 (0.888)	-1.124 \pm 0.649 -1.732 (0.089)

Table S19: Coefficient table for Model S8 at pH ~ 6.5. Coefficients \pm SE, and t -values are presented. Significance (p) values are in parentheses (headers indicate the baseline).

	Ctrl	Af	Al	Ap	Cg	Nh	Ss
Af	1.852 \pm 0.497 3.726 ($<$ 0.000)	-	-	-	-	-	-
Al	-0.291 \pm 0.228 -1.273 (0.208)	-2.150 \pm 0.577 -3.724 (0.001)	-	-	-	-	-
Ap	0.981 \pm 0.455 2.156 (0.035)	-0.931 \pm 0.584 -1.595 (0.116)	1.218 \pm 0.604 2.017 (0.049)	-	-	-	-
Cg	1.719 \pm 0.485 3.547 (0.001)	-0.149 \pm 0.596 -0.250 (0.803)	2.000 \pm 0.613 3.262 (0.002)	0.782 \pm 0.590 1.327 (0.190)	-	-	-
Nh	-0.047 \pm 0.400 -0.118 (0.907)	-1.937 \pm 0.582 -3.330 (0.002)	0.212 \pm 0.602 0.353 (0.726)	-1.006 \pm 0.570 -1.766 (0.083)	-1.788 \pm 0.577 -3.101 (0.003)	-	-
Ss	0.563 \pm 0.750 0.751 (0.481)	-1.315 \pm 0.650 -2.025 (0.089)	0.834 \pm 0.661 1.263 (0.254)	-0.384 \pm 0.649 -0.591 (0.576)	-1.166 \pm 0.656 -1.777 (0.126)	0.622 \pm 0.647 0.962 (0.373)	-
Tc	0.491 \pm 0.311 1.579 (0.120)	-1.371 \pm 0.574 -2.390 (0.020)	0.778 \pm 0.596 1.306 (0.197)	-0.440 \pm 0.573 -0.767 (0.446)	-1.222 \pm 0.594 -2.056 (0.044)	0.566 \pm 0.574 0.987 (0.328)	-0.056 \pm 0.649 -0.086 (0.932)