Supplementary Information

Supplemental Tables

Table S1. Average water chemistry for true ambient vs ambient chamber values measured in the seagrass site and open estuary site. Values are reported as mean ± SD for total alkalinity (A_T; µmol kg^{-1}), dissolved inorganic carbon (DIC; µmol kg^{-1}), partial pressure of carbon dioxide (pCO_2; calculated), Revelle factor (Rf), saturation state of aragonite (Ω_{Ar}), pH (pH_T; total scale H^+), dissolved oxygen (DO; mg L^{-1}), chlorophyll-*a* (chl-*a*; µg L^{-1}) and temperature (°C).

Parameter	**True Ambient**	**True Ambient**	**Ambient**	**Ambient**
	Seagrass	**Open water**	**Seagrass**	**Open water**
A_T (µmol kg^{-1})	1944 ± 59	1967 ± 31	1956 ± 55	1964 ± 26
DIC (µmol kg^{-1})	1758 ± 31	1817 ± 20	1748 ± 14	1808 ± 23
pCO_2 (µatm)	529 ± 295	560 ± 74	427 ± 132	539 ± 65
Rf	11.8 ± 2.7	12.74 ± 0.7	11.03 ± 1.94	12.47 ± 0.7
Ω_{Ar}	2.18 ± 0.85	1.79 ± 0.22	2.39 ± 0.71	1.87 ± 0.21
pH_T	7.93 ± 0.19	7.91 ± 0.05	7.99 ± 0.11	7.89 ± 0.05
Chl-*a* (µg L^{-1})	6.71 ± 3.83	4.1 ± 0.7	6.04 ± 2.73	2.19 ± 0.59
Temp (°C)	23.62 ± 2.21	22.4 ± 1.6	23.79 ± 2.36	22.77 ± 1.56

Table S2. Summary of Two-Way ANOVA assessing substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified) on growth rate (µm day^{-1}) of 5 mm bay scallops. Degrees of freedom are equal to 73. Pairwise comparisons are found in Table S6.

	F	*p*
Substrate	1.95	0.17
Treatment	17.18	< 0.05*
Substrate x Treatment	3.53	0.06

Table S3. Pairwise comparisons for growth rate (mm day^{-1}) of 5 mm bay scallops. Groups refer to the specific combination of substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified). N refers to the number of treatment replicates. *p* values were corrected using the holm-sidak test.

Group 1	Group 2	N1	N2	*p*
Open: Ambient	Open: Acidified	16	18	< 0.001 ***
Open: Ambient	Seagrass: Ambient	16	25	0.1
Open: Acidified	Seagrass: Ambient	18	25	0.1
Open: Ambient	Seagrass: Acidified	16	18	< 0.001 **
Open: Acidified	Seagrass: Acidified	18	18	0.7
Seagrass: Ambient	Seagrass: Acidified	25	18	0.44

Table S4. Summary of Two-Way ANOVA assessing substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified) on growth rate (µm day^{-1}) for 11 mm bay scallops. Degrees of freedom are equal to 85. Pairwise comparisons are found in Table S8.

	F	*p*
Substrate	8.27	< 0.05*
Treatment	18.35	< 0.05*
Substrate x Treatment	1.26	0.27

Table S5. Pairwise comparisons for growth rate (mm day^{-1}) of 11 mm bay scallops. Groups refer to the specific combination of substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified). N refers to the number of treatment replicates. *p* values were corrected using the holm-sidak test.

Group 1	Group 2	N1	N2	*p*
Open: Ambient	Open: Acidified	22	20	< 0.001 **
Open: Ambient	Seagrass: Ambient	22	22	0.4
Open: Acidified	Seagrass: Ambient	20	22	< 0.001 ****
Open: Ambient	Seagrass: Acidified	22	25	0.4
Open: Acidified	Seagrass: Acidified	20	25	< 0.01*
Seagrass: Ambient	Seagrass: Acidified	22	25	0.06

Table S6. Summary of Two-Way ANOVA assessing substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified) on growth rate (μm day^{-1}) for juvenile oysters. Degrees of freedom are equal to 242. Pairwise comparisons are found in Table S10.

	F	*p*
Substrate	0.98	0.32
Treatment	29.4	< 0.001 *
Substrate x Treatment	1.07	0.3

Table S7. Pairwise comparisons for growth rate (μm day^{-1}) of juvenile oysters. Groups refer to the specific combination of substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified). N refers to the number of treatment replicates. *p* values were corrected using the holm-sidak test.

Group 1	**Group 2**	**N1**	**N2**	***p***
Open: Ambient	Open: Acidified	83	83	< 0.001 ****
Open: Ambient	Seagrass: Ambient	83	43	0.3
Open: Acidified	Seagrass: Ambient	83	43	< 0.01 *
Open: Ambient	Seagrass: Acidified	83	37	< 0.001 ***
Open: Acidified	Seagrass: Acidified	83	37	0.9
Seagrass: Ambient	Seagrass: Acidified	43	37	0.07

Table S8. Summary of Two-Way ANOVA assessing substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified) on mortality (%) for 5 mm bay scallops. Degrees of freedom are equal to 8. Pairwise comparisons are found in Table S12.

	F	*p*
Substrate	54.7	< 0.001 *
Treatment	17.9	< 0.01 *
Substrate x Treatment	2.39	0.1

Table S9. Pairwise comparisons for mortality (%) of 5 mm bay scallops. Groups refer to the specific combination of substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified). N refers to the number of treatment replicates. *p* values were corrected using the holm-sidak test.

Group 1	**Group 2**	**N1**	**N2**	***p***
Open: Ambient	Open: Acidified	3	3	0.1
Open: Ambient	Seagrass: Ambient	3	3	< 0.001 **
Open: Acidified	Seagrass: Ambient	3	3	< 0.001 ***
Open: Ambient	Seagrass: Acidified	3	3	0.1
Open: Acidified	Seagrass: Acidified	3	3	0.01 *
Seagrass: Ambient	Seagrass: Acidified	3	3	0.01 *

Table S10. Summary of Two-Way ANOVA assessing substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified) on mortality (%) for 11 mm bay scallops. Degrees of freedom are equal to 8.

	F	*p*
Substrate	0.0	1
Treatment	0.21	0.7
Substrate x Treatment	0.21	0.7

Table S11. Summary of Two-Way ANOVA assessing substrate (Open Estuary vs. Seagrass) and treatment (Ambient vs. Acidified) on mortality (%) for juvenile oysters. Degrees of freedom are equal to 8.

	F	*p*
Substrate	1.63	0.23
Treatment	2.85	0.13
Substrate x Treatment	2.18	0.18

Supplemental Figures

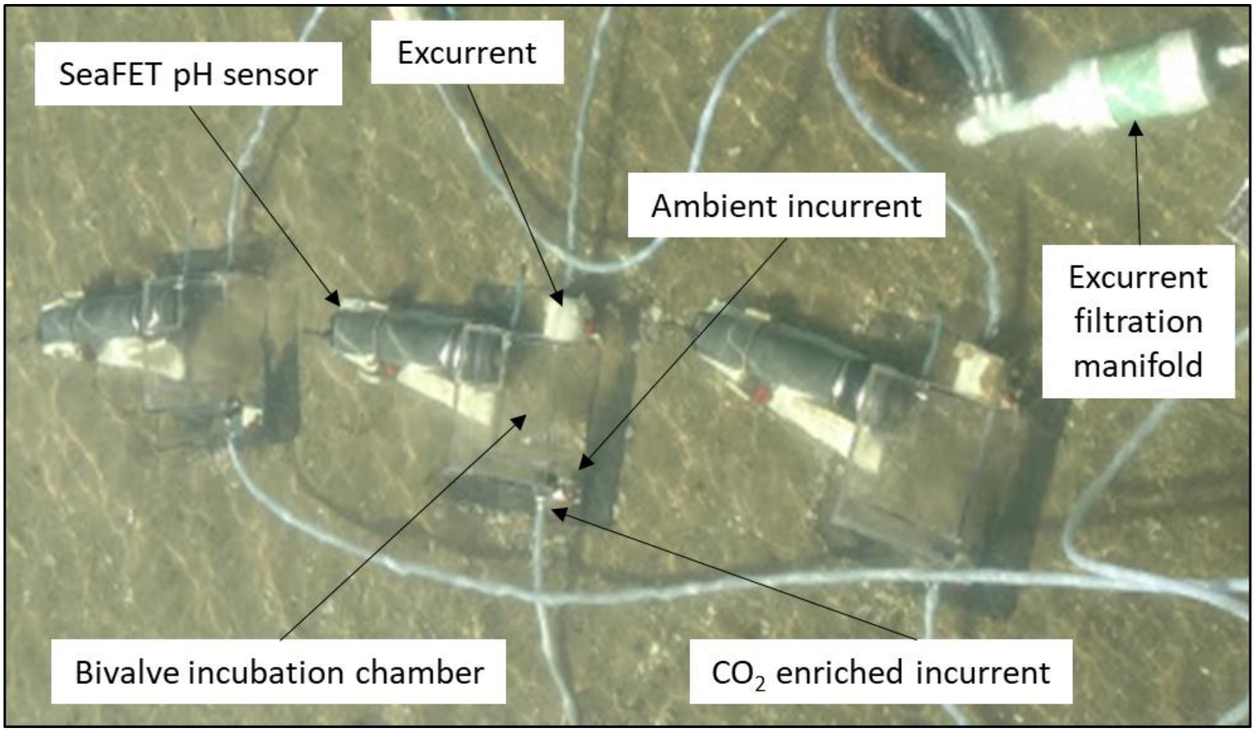

Figure S1. Overhead image of the system showing three, replicate, CO_2 enriched, bivalve incubation chambers at the open water site. Pump manifold, injection system, and raceway are not shown.

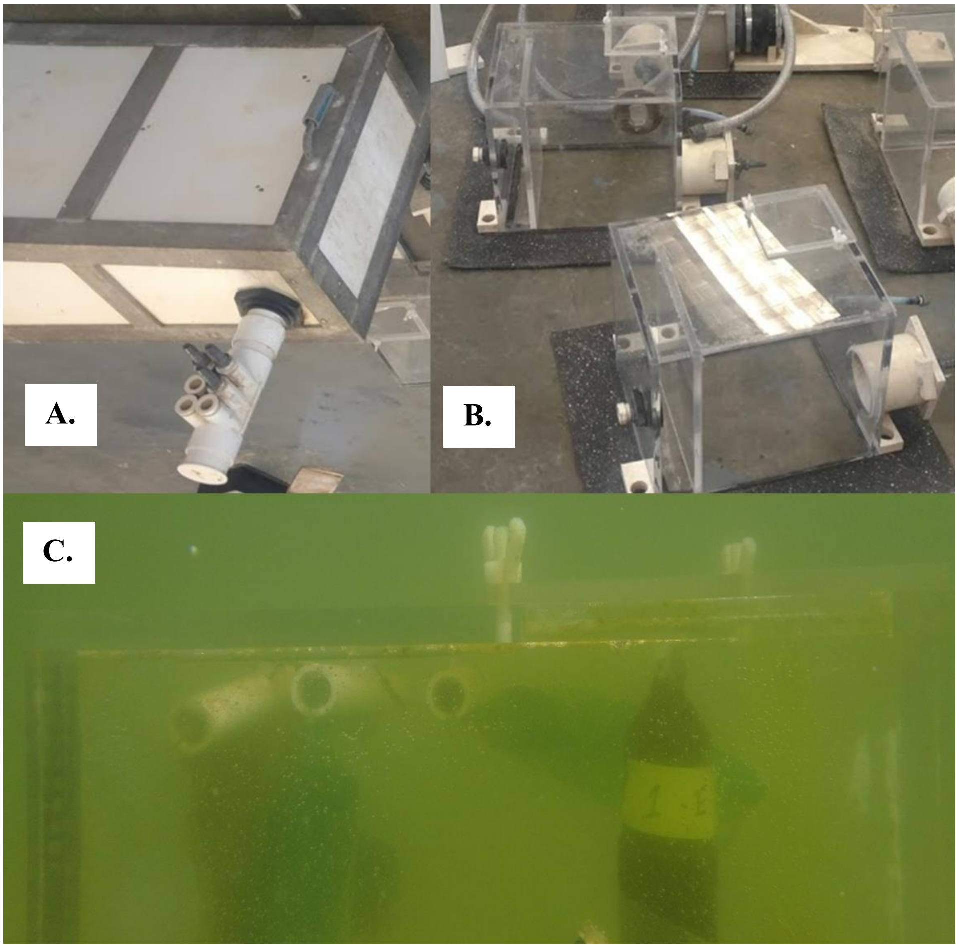

Figure S2. A) Raceway acidification path, **B)** bivalve incubation chambers, and **C)** bivalve deployment in seagrass meadow.

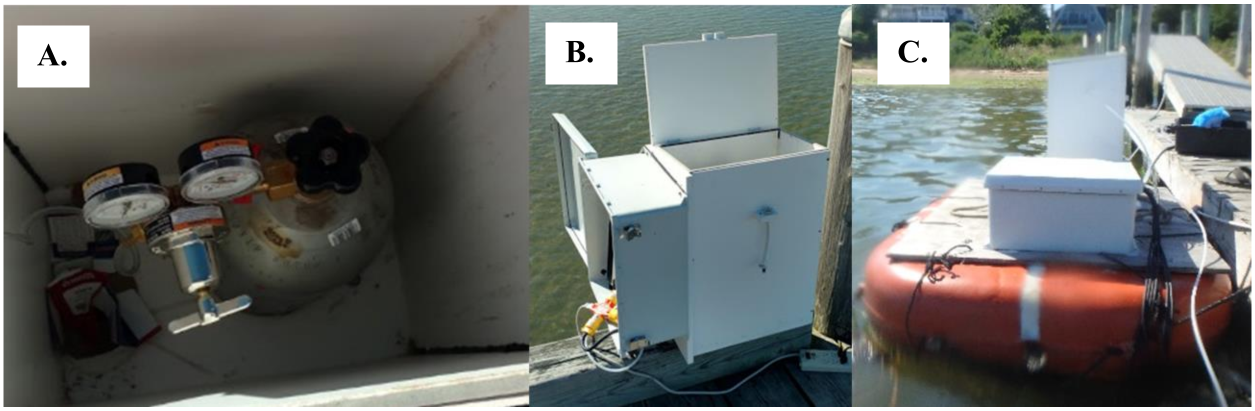

Figure S3. A) CO_2 tank and regulator, **B)** acidification platform at open water site, and **C)** acidification float at seagrass site.

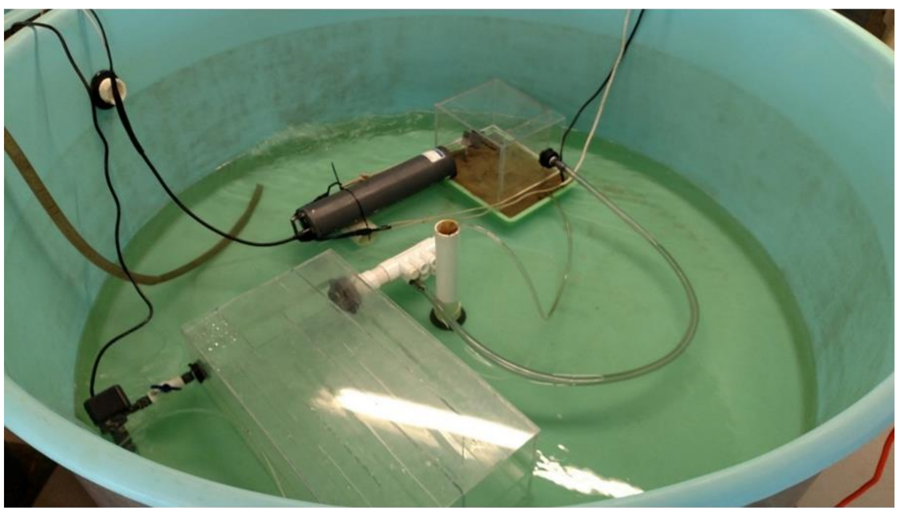

Figure S4. Prototype testing chamber

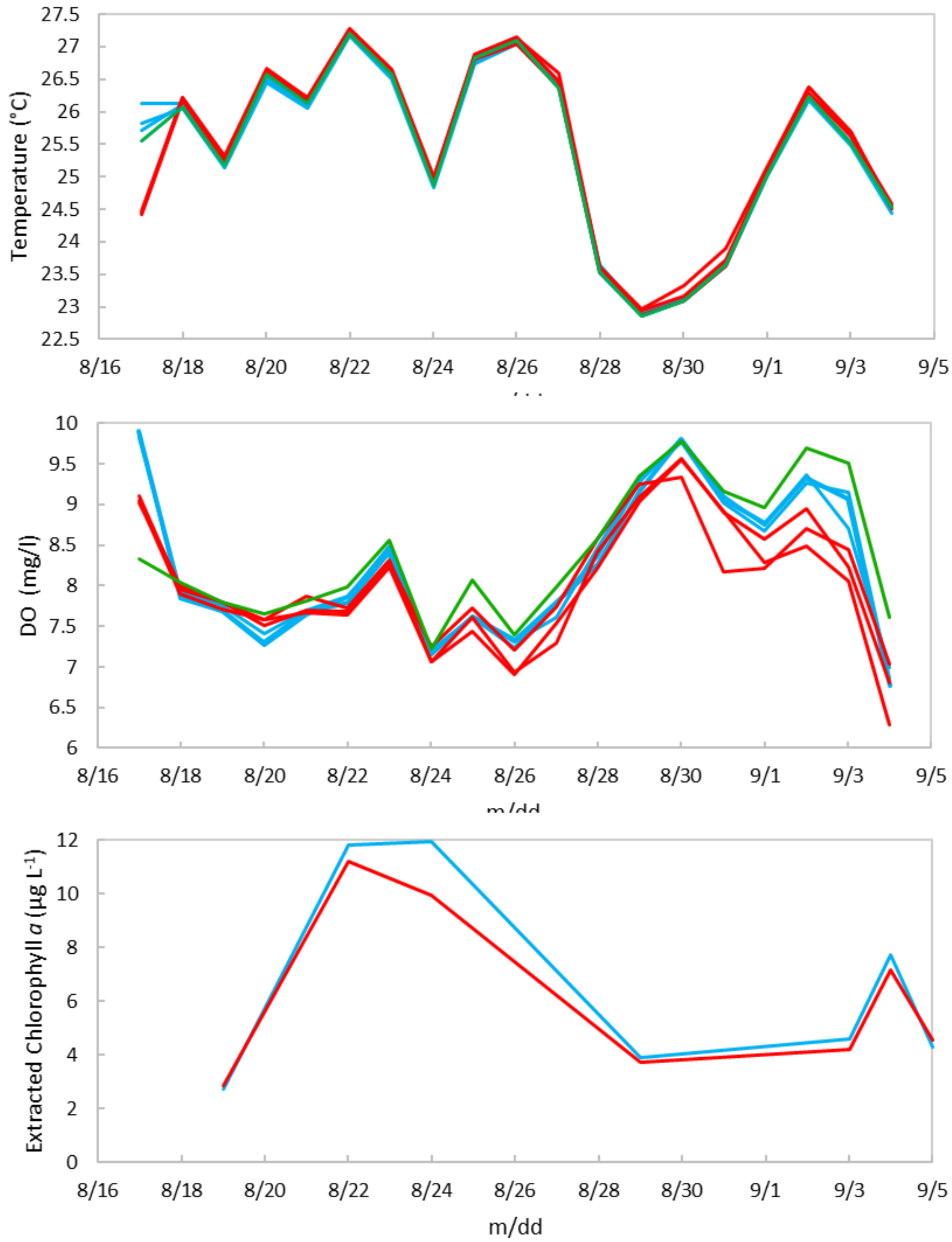

Figure S5. Time series of mean daily Temperature (°C), DO (mg L^{-1}), and extracted chlorophyll *a* (µg L^{-1}) at telemetry station (green), in ambient chambers (blue), and CO_2 enrichment chambers (red) during the summer experiment at the seagrass site.

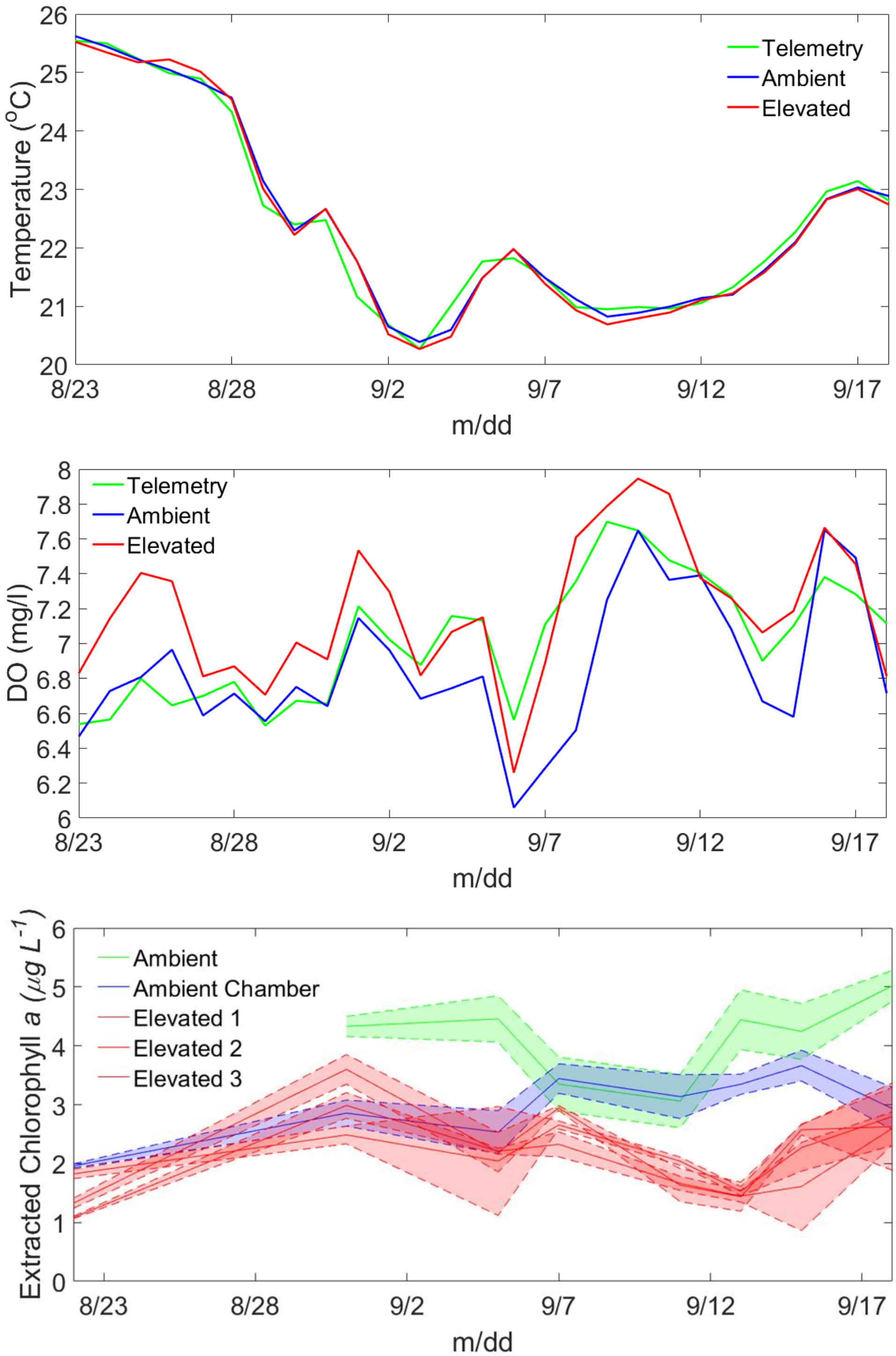

Figure S6. Time series of mean daily Temperature (°C), DO (mg L^{-1}), and extracted chlorophyll *a* (μg L^{-1}) ± SD at telemetry station (green), ambient chambers (blue), and CO_2 enrichment chambers (red) during the summer experiment at the open water site.