Supplementary Materials for:

Nano-TiO_2 and elevated temperature impair intestinal health in crabs via a mussel-based food chain

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Table S1 The interactive effects of nano-TiO_2, warming, exposures, and their combination on *C. japonica* digestive enzymes and ATP variation.

Parameters / 3W-ANOVA results	Lipase		Amylase		Trypsin		ATP	
Source of Variation	**% OTV**	***P*-value**	**% OTV**	***P*-value**	**% OTV**	***P*-value**	**% OTV**	***P*-value**
Direct vs. indirect vs. combined exposures	49.30	<0.0001	14.37	<0.0001	16.83	<0.0001	17.36	<0.0001
Normal vs. high temperature	0.0005	0.92	1.73	0.009	15.44	<0.0001	3.50	0.006
zero vs high nano-TiO_2	12.37	<0.0001	13.73	<0.0001	0.01	0.82	7.27	0.0001
Direct vs. indirect vs combined exposures x Normal vs. high temperature	2.46	<0.0001	29.60	<0.0001	7.94	<0.0001	4.82	0.005
Direct vs. indirect vs. combined exposures x zero vs. high nano-TiO_2	18.34	<0.0001	1.25	0.08	7.46	0.0001	17.52	<0.0001
Normal vs. high temperature x zero vs. high nano-TiO_2	2.90	<0.0001	20.56	<0.0001	14.20	<0.0001	8.27	<0.0001
Direct vs. indirect vs. combined exposures x Normal vs. high temperature x zero vs. high nano-TiO_2	11.75	<0.0001	7.39	<0.0001	16.33	<0.0001	15.39	<0.0001

% OTV: percentage of total variation contribution.

Table S2 The interactive effects of nano-TiO_2, warming, exposures, and their combination on *C. japonica* proximate chemical composition variation.

Parameters / 3W-ANOVA results	Protein		Lipid		Carbohydrate		Ash		Moisture	
Source of Variation	**% OTV**	***P*-value**	**% OTV**	***P*-value**	**% OTV**	***P*-value**	**% OTV**	***P*-value**	**% OTV**	***P*-value**
Direct vs. indirect vs. combined exposures	9.37	<0.0001	19.33	<0.0001	7.36	<0.0001	11.75	0.008	3.06	0.002
Normal vs. high temperature	52.65	<0.0001	10.93	<0.0001	63.77	<0.0001	0.005	0.94	51.13	<0.0001
zero vs high nano-TiO_2	10.25	<0.0001	3.91	0.004	6.28	<0.0001	6.34	0.02	7.05	<0.0001
Direct vs. indirect vs combined exposures x Normal vs. high temperature	1.73	0.01	5.17	0.005	0.57	0.08	6.03	0.07	0.38	0.44
Direct vs. indirect vs. combined exposures x zero vs. high nano-TiO_2	1.49	0.01	28.19	<0.0001	2.54	<0.0001	0.15	0.93	9.40	<0.0001
Normal vs. high temperature x zero vs. high nano-TiO_2	13.18	<0.0001	0.13	0.58	12.00	<0.0001	7.30	0.01	12.29	<0.0001
Direct vs. indirect vs. combined exposures x Normal vs. high temperature x zero vs. high nano-TiO_2	0.66	0.16	4.83	0.007	0.62	0.07	0.37	0.84	2.68	0.005

% OTV: percentage of total variation contribution.

Table S3 The interactive effects of $AnTiO_2$, warming, exposures, and their combination on *C. japonica* alpha diversity estimators' variation.

Parameters / 3W-ANOVA results	Chao1		Simpson		Shannon	
Source of Variation	**% OTV**	***P*-value**	**% OTV**	***P*-value**	**% OTV**	***P*-value**
Direct vs. indirect vs. combined exposures	1.65	0.18	33.43	<0.0001	24.81	<0.0001
Normal vs. high temperature	8.86	0.0001	0.56	0.23	4.27	0.03
zero vs. high nano-TiO_2	5.59	0.001	17.49	<0.0001	5.67	0.01
Direct vs. indirect vs. combined exposures x Normal vs. high temperature	31.72	<0.0001	23.60	<0.0001	20.72	0.0002
Direct vs. indirect vs. combined exposures x zero vs. high nano-TiO_2	7.27	0.001	8.48	0.0002	3.59	0.15
Normal vs. high temperature x zero vs. high nano-TiO_2	9.71	<0.0001	0.20	0.46	6.19	0.01
Direct vs. indirect vs. combined exposures x Normal vs. high temperature x zero vs. high nano-TiO_2	18.29	<0.0001	2.33	0.06	1.18	0.53

% OTV: percentage of total variation contribution.