

Supplementary material

Fatty acid extraction method

Collected macroalgal and amphipod samples were kept frozen until lyophilization and FA analysis at the Oregon Institute of Marine Biology (OIMB). Following lyophilization, samples of each macroalga and three sets of pooled samples of amphipods fed each diet were homogenized, lipid extracted, and transesterified to produce fatty acid methyl esters (FAME) for analysis (Taipale et al. 2016). During the initial lipid extraction, we added C19:0 as an internal standard to each sample. To extract total lipids, homogenized tissue samples were digested in a 4:2:1 chloroform: methanol:0.9% NaCl solution twice. From the resulting pooled organic layers, 1-ml was removed for transesterification, evaporated under N₂ flow, and the organics were re-suspended in a toluene and 1% sulfuric-acid methanol solution and maintained at 90°C for 90 min to trans-esterify FAME. FAME solutions were then neutralized with 2% KHCO₃, diluted with hexane, vortexed, and centrifuged before carefully transferring the FAME layer to 2-ml glass vials for gas chromatography. FAME dissolved in hexane were analyzed, identified, and quantified using gas chromatography mass spectrometry following Taipale et al. (2016). We quantitatively measured FAME concentrations using a serial dilution of a mixed external FA standard (Nu-chek Prep 566C) and calculated relative proportions of each identified FA from the area under each sample peak.

References

TAIPALE, S.J., HILTUNEN, M., VUORIO, K. & PELTOMAA, E. 2016. Suitability of phytosterols alongside fatty acids as chemotaxonomic biomarkers for phytoplankton. *Frontiers in Plant Science*, **7**, 212.

Table S1. Results of PERMANOVA analysis of proportions of identified FA contributing $\geq 1\%$ of identified FA for macroalgae and *G. antarctica* (data untransformed, Euclidean distance) for comparisons between tissue types (alga vs. amphipod), algal species (live vs. dead for macroalgae and initial vs. final for diatoms), and amphipods maintained on experimental diets.

Source	df	SS	MS	Pseudo-F	P(perm)	Unique perms
<i>Macroalga/amphipod tissue</i>	1	5453	5453	12	0.0001*	9945
<i>Residuals</i>	60	27676	461			
<i>Total</i>	61	33128				
<i>Macroalga species</i>	3	19229	6410	81	0.0001*	9934
<i>Live/Dead</i>	1	1233	1233	16	0.0001*	9960
<i>Interaction</i>	2	1140	570	7	0.0001*	9929
<i>Residuals</i>	37	2938	79			
<i>Total</i>	43	26599				
<i>Amphipod diet</i>	4	1062	265	230	0.0001*	9949
<i>Residuals</i>	13	15	1			
<i>Total</i>	17	1077				

Table S2. The fatty acid (FA) composition of tissues from Antarctic macroalgae. The mean \pm standard deviation (sd) are reported as a proportion of FA identified. FA that contributed to $\geq 1\%$ for at least one tissue type analyzed (for macroalgae or amphipods) are reported. --- indicates instances in which FA proportions were < 0.001 .

	<i>Desmarestia</i>				diatom				<i>Himantothallus</i>				<i>Palmaria</i>	
	live (N = 6)		dead (N = 7)		initial (N = 6)		final (N = 6)		live (N = 6)		dead (N = 7)		live (N = 6)	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
14:0	6.0	1.0	6.4	1.4	8.2	2.0	8.1	0.4	5.6	1.0	5.0	0.6	4.8	2.1
16:0	8.8	3.2	10.1	6.5	18.0	0.8	19.7	0.5	19.8	1.5	24.1	2.0	15.7	2.1
16:1 ω 7	4.6	0.9	5.3	0.9	18.1	3.6	37.6	1.1	7.9	5.6	14.4	3.8	3.9	2.3
16:1 ω 5	1.0	0.3	1.1	0.5	0.4	0.1	0.6	0.0	1.9	0.9	1.8	0.7	0.2	0.1
16:3 ω 4	0.3	0.3	0.0	0.0	23.8	6.2	9.0	0.4	0.7	1.4	0.2	0.2	0.1	0.1
16:4 ω 1	---	---	---	---	0.7	0.4	0.8	0.0	0.0	0.0	---	---	0.1	0.3
18:0	8.1	2.9	9.6	3.5	1.2	0.4	0.6	0.1	2.9	0.9	2.3	0.3	1.6	0.5
18:1 ω 9	22.0	3.5	24.8	1.9	4.2	3.0	1.6	0.2	13.1	3.6	13.4	2.4	5.6	4.2
18:1 ω 7	0.5	0.3	0.6	0.5	1.9	1.9	1.0	0.1	0.6	0.2	2.2	1.4	3.1	1.4
18:2 ω 6	9.0	2.1	9.0	2.3	0.7	0.1	0.7	0.0	4.4	1.5	3.7	0.4	0.9	0.4
18:3 ω 6	0.5	0.1	0.5	0.1	0.3	0.0	3.2	0.1	0.0	0.0	---	---	0.0	0.1
18:3 ω 3	4.5	0.5	3.4	0.4	1.3	0.2	0.5	0.0	4.9	1.7	3.6	0.7	0.3	0.2
18:4 ω 4	4.2	1.5	2.0	0.6	0.8	0.5	2.2	0.1	3.7	0.9	2.6	1.0	0.4	0.3
20:0	2.1	0.7	2.8	0.7	0.1	0.0	0.0	0.0	1.5	0.5	1.8	0.8	0.1	0.0
20:1 ω 9	0.0	0.0	0.1	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.2	1.0	0.3
20:3 ω 6	1.3	0.4	1.5	0.5	---	---	0.1	0.0	0.1	0.1	0.0	0.1	0.1	0.2
20:4 ω 6	13.9	1.7	13.4	1.2	1.4	0.2	1.0	0.1	14.4	5.6	11.5	2.6	1.1	2.2
20:5 ω 3	10.9	2.2	7.1	1.0	13.7	4.7	11.3	0.6	11.8	7.8	6.7	1.9	48.8	10.3
22:1 ω 9	0.6	0.8	0.3	0.2	0.0	0.0	---	---	2.5	1.7	2.2	0.6	4.6	3.0
22:2 ω 6	---	---	---	---	0.2	0.1	0.1	0.0	0.0	0.0	---	---	0.1	0.2
24:0	0.0	0.0	---	---	0.8	1.5	0.1	0.0	2.4	1.2	1.8	0.5	0.3	0.6
ω -3	15.3	2.6	10.5	1.4	15.0	5.0	11.8	0.6	16.7	9.6	10.3	2.6	49.1	10.5
ω -6	10.3	2.5	10.5	2.8	0.9	0.2	0.8	0.0	4.5	1.6	3.7	0.5	1.1	0.8
ω -3: ω -6	1.5	1.0	1.0	0.5	17.3	31.6	14.5	12.6	3.7	5.9	2.8	4.8	44.9	13.2
SAFA	25.1	7.9	29.0	12.1	28.3	4.8	28.6	1.0	32.1	5.0	35.0	4.2	22.6	5.3
MUFA	28.7	5.8	32.2	3.9	24.8	8.8	40.7	1.5	26.0	12.1	34.2	9.0	18.4	11.3
PUFA	35.6	6.5	27.9	3.7	42.0	12.3	28.0	1.3	35.6	17.6	24.7	6.5	51.0	13.7
LCPUFA	26.2	4.2	22.0	2.7	15.1	5.0	12.3	0.7	26.2	13.6	18.3	4.6	50.1	12.6

Table S3. The fatty acid (FA) composition of tissues from *Gondogeneia antarctica* maintained on experimental diets. The mean \pm standard deviation (sd) are reported as a proportion of FA identified. FA that contributed to $\geq 1\%$ for at least one tissue type analyzed (for macroalgae or amphipods) are reported. Pseudo N refers to the number of amphipods analyzed from each treatment because amphipods were not maintained individually for the full duration of the experimental period. --- indicates instances in which FA proportions were < 0.001 .

	wild		<i>Desmarestia</i>		diatom		<i>Himantothallus</i>		<i>Palmaria</i>	
	pseudo N = 6		pseudo N = 3		pseudo N = 3		pseudo N = 3		pseudo N = 3	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
14:0	2.5	0.1	0.8	0.1	1.6	0.0	0.2	0.0	1.4	0.1
16:0	12.7	0.2	14.4	0.2	15.8	0.2	14.9	0.3	15.4	0.1
16:1 ω 7	8.5	0.2	2.5	0.3	10.6	0.3	0.6	0.0	3.7	0.3
16:1 ω 5	0.2	0.0	0.1	0.0	0.2	0.0	0.1	0.0	0.1	0.0
16:3 ω 4	2.5	0.2	0.3	0.1	3.1	0.1	---	---	0.7	0.1
16:4 ω 1	7.9	0.3	0.6	0.2	0.5	0.0	---	---	1.5	0.2
18:0	1.1	0.1	2.5	0.0	2.0	0.0	2.7	0.2	2.0	0.1
18:1 ω 9	7.0	0.6	14.0	0.1	11.3	0.1	13.1	0.3	12.0	0.2
18:1 ω 7	3.5	0.1	3.4	0.0	3.8	0.0	3.0	0.1	4.2	0.1
18:2 ω 6	1.4	0.2	1.8	0.1	1.0	0.0	0.8	0.0	1.1	0.0
18:3 ω 6	0.6	0.0	0.1	0.0	1.0	0.0	0.0	0.0	0.2	0.0
18:3 ω 3	1.8	0.2	0.8	0.1	0.5	0.0	0.3	0.0	0.6	0.1
18:4 ω 4	6.6	0.2	1.0	0.2	1.0	0.0	0.1	0.0	1.6	0.3
20:0	0.0	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.0
20:1 ω 9	0.7	0.0	1.2	0.0	1.1	0.0	1.3	0.0	1.6	0.1
20:3 ω 6	0.2	0.0	0.3	0.0	0.2	0.0	0.1	0.0	0.2	0.0
20:4 ω 6	0.6	0.0	5.5	0.1	1.9	0.1	3.0	0.2	1.1	0.1
20:5 ω 3	29.1	0.9	31.8	1.0	27.7	0.5	36.7	1.0	34.8	0.8
22:1 ω 9	0.2	0.0	0.2	0.0	0.2	0.0	0.1	0.0	0.5	0.0
22:2 ω 6	1.1	0.1	0.5	0.0	0.7	0.0	0.4	0.0	0.7	0.0
24:0	1.1	0.1	1.5	0.1	1.5	0.1	1.6	0.0	1.9	0.2
ω -3	30.9	1.0	32.6	1.1	28.2	0.5	37.0	1.0	35.4	0.8
ω -6	2.8	0.3	2.6	0.1	1.9	0.0	1.3	0.1	2.0	0.1
ω -3: ω -6	11.2	3.3	12.7	8.9	14.9	17.5	29.0	14.2	18.2	14.7
SAFA	17.5	0.4	19.4	0.4	20.9	0.3	19.4	0.6	20.8	0.5
MUFA	19.9	0.9	21.4	0.5	27.1	0.5	18.2	0.5	22.1	0.6
PUFA	49.3	1.8	40.5	1.6	36.0	0.8	40.1	1.3	40.6	1.4
LCPUFA	29.8	0.9	37.6	1.1	29.8	0.6	39.8	1.2	36.1	0.8

Table S4. The concentration of fatty acids (FA) in tissues from Antarctic macroalgae (mean \pm sd, $\mu\text{g mg}^{-1}$ dry tissue). FA that contributed to $\geq 1\%$ for at least one tissue type analyzed (for macroalgae or amphipods) are reported. --- indicates instances in which FA concentrations were < 0.001 .

	<i>Desmarestia</i>		diatom				<i>Himantothallus</i>				<i>Palmeria</i>			
	initial (N = 6)		final (N = 7)		initial (N = 6)		final (N = 6)		initial (N = 6)		final (N = 7)		initial (N = 6)	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
14:0	1.12	0.68	1.94	0.66	0.51	0.07	1.25	0.08	0.11	0.05	0.12	0.03	0.20	0.05
16:0	1.50	0.75	2.76	0.82	1.20	0.48	3.03	0.18	0.39	0.16	0.58	0.14	1.26	1.76
16:1 ω 7	0.95	0.68	1.74	0.85	1.14	0.22	5.79	0.37	0.18	0.20	0.34	0.09	0.26	0.31
16:1 ω 5	0.18	0.09	0.33	0.12	0.03	0.01	0.09	0.00	0.04	0.02	0.04	0.02	0.01	0.01
16:3 ω 4	0.04	0.03	0.01	0.01	1.48	0.28	1.39	0.06	0.02	0.04	0.00	0.00	0.02	0.04
16:4 ω 1	---	---	---	---	0.05	0.06	0.13	0.00	---	---	---	---	0.04	0.09
18:0	1.79	1.36	3.30	1.86	0.09	0.06	0.10	0.01	0.05	0.01	0.06	0.01	0.18	0.33
18:1 ω 9	4.52	2.90	7.90	3.28	0.34	0.42	0.24	0.02	0.24	0.09	0.32	0.08	0.90	1.88
18:1 ω 7	0.08	0.05	0.21	0.22	0.17	0.25	0.15	0.02	0.01	0.01	0.05	0.03	0.28	0.44
18:2 ω 6	1.90	1.28	3.01	1.50	0.05	0.03	0.10	0.00	0.08	0.04	0.09	0.02	0.12	0.22
18:3 ω 6	0.11	0.07	0.15	0.08	0.02	0.01	0.49	0.03	0.00	0.00	---	---	0.01	0.02
18:3 ω 3	0.84	0.46	1.08	0.48	0.08	0.02	0.07	0.00	0.09	0.03	0.09	0.03	0.05	0.10
18:4 ω 4	0.71	0.32	0.62	0.23	0.07	0.07	0.34	0.01	0.07	0.02	0.06	0.04	0.06	0.14
20:0	0.47	0.36	0.95	0.49	0.00	0.00	0.01	0.00	0.03	0.01	0.04	0.03	0.01	0.02
20:1 ω 9	0.01	0.01	0.01	0.00	0.02	0.03	0.00	0.00	---	---	0.00	0.00	0.09	0.15
20:3 ω 6	0.28	0.18	0.50	0.28	---	---	0.01	0.00	0.00	0.00	0.00	0.00	0.02	0.04
20:4 ω 6	2.60	1.41	4.23	1.71	0.09	0.03	0.15	0.01	0.26	0.13	0.28	0.09	0.32	0.76
20:5 ω 3	1.96	1.01	2.30	1.10	1.04	0.90	1.74	0.04	0.27	0.27	0.16	0.07	3.30	3.70
22:1 ω 9	0.06	0.02	0.07	0.03	---	---	---	---	0.04	0.02	0.05	0.02	0.16	0.10
22:2 ω 6	---	---	---	---	0.01	0.01	0.02	0.00	---	---	---	---	0.03	0.07
24:0	0.02	0.04	0.03	0.01	0.26	0.20	0.18	0.02	0.00	0.01	0.02	0.01	0.74	1.82
ω -3	2.94	1.56	3.59	1.67	1.16	0.94	1.86	0.04	0.43	0.28	0.30	0.12	3.59	4.13
ω -6	4.97	2.97	8.04	3.62	0.18	0.08	0.76	0.02	0.35	0.16	0.37	0.11	0.53	1.19
ω -3: ω -6	0.65	0.15	0.45	0.07	5.99	1.82	2.45	0.10	1.46	1.52	0.82	0.24	37.23	20.26
SAFA	5.00	3.23	9.16	3.42	2.08	0.79	4.62	0.20	0.60	0.23	0.83	0.19	2.44	3.96
MUFA	5.80	3.71	10.27	4.38	1.71	0.90	6.26	0.35	0.52	0.24	0.81	0.17	1.72	2.77
PUFA	6.54	3.41	8.89	3.78	2.84	1.25	4.31	0.10	0.72	0.33	0.60	0.21	3.82	4.88
LCPUFA	0.03	0.03	0.04	0.02	0.02	0.02	0.02	0.00	0.05	0.03	0.04	0.02	0.13	0.30

Table S5. The concentration of fatty acid (FA) in tissues from *Gondogeneia antarctica* maintained on experimental diets (mean \pm sd, $\mu\text{g mg}^{-1}$). FA that contributed to $\geq 1\%$ for at least one tissue type analyzed (for macroalgae or amphipods) are reported. Pseudo N refers to the number of amphipods analyzed from each treatment because amphipods were not maintained individually for the full duration of the experimental period. --- indicates instances in which FA concentrations were < 0.001 .

	wild		<i>Desmarestia</i>		diatom		<i>Himantothallus</i>		<i>Palmeria</i>	
	pseudo N = 6		pseudo N = 3		pseudo N = 3		pseudo N = 3		pseudo N = 3	
	mean	sd	mean	sd	mean	sd	mean	sd	mean	sd
14:0	2.69	0.55	0.31	0.05	0.75	0.04	0.04	0.01	0.76	0.10
16:0	13.41	2.16	5.81	0.27	7.49	0.24	3.86	0.34	8.34	0.76
16:1 ω 7	8.98	1.53	1.00	0.19	5.03	0.20	0.16	0.02	2.01	0.31
16:1 ω 5	0.18	0.04	0.05	0.01	0.08	0.00	0.01	0.01	0.07	0.01
16:3 ω 4	2.67	0.47	0.11	0.04	1.49	0.05	---	---	0.37	0.06
16:4 ω 1	8.37	1.47	0.26	0.08	0.25	0.01	---	---	0.80	0.17
18:0	1.21	0.22	1.02	0.07	0.93	0.00	0.69	0.09	1.08	0.07
18:1 ω 9	7.43	1.64	5.63	0.30	5.35	0.11	3.39	0.28	6.46	0.57
18:1 ω 7	3.66	0.61	1.39	0.10	1.80	0.04	0.79	0.08	2.27	0.25
18:2 ω 6	1.55	0.48	0.72	0.07	0.47	0.01	0.20	0.02	0.61	0.08
18:3 ω 6	0.66	0.14	0.05	0.01	0.47	0.02	0.01	0.01	0.11	0.02
18:3 ω 3	1.93	0.47	0.34	0.06	0.24	0.01	0.07	0.00	0.33	0.07
18:4 ω 4	6.99	1.33	0.43	0.10	0.49	0.03	0.02	0.01	0.85	0.22
20:0	0.05	0.01	0.07	0.01	0.03	0.00	0.02	0.00	0.04	0.00
20:1 ω 9	0.71	0.13	0.49	0.02	0.53	0.00	0.35	0.04	0.86	0.05
20:3 ω 6	0.18	0.04	0.11	0.01	0.09	0.00	0.02	0.01	0.09	0.01
20:4 ω 6	0.63	0.12	2.21	0.12	0.91	0.03	0.78	0.08	0.57	0.02
20:5 ω 3	30.65	4.49	12.81	0.40	13.17	0.52	9.52	0.74	18.85	2.18
22:1 ω 9	0.18	0.03	0.07	0.00	0.07	0.00	0.03	0.01	0.29	0.02
22:2 ω 6	1.21	0.21	0.21	0.02	0.34	0.00	0.11	0.01	0.36	0.03
24:0	6.93	0.95	5.49	0.37	5.79	0.13	4.90	0.20	6.04	0.24
ω -3	37.12	5.70	14.35	0.49	14.64	0.52	10.28	0.79	21.02	2.34
ω -6	4.48	1.01	3.55	0.23	2.48	0.03	1.24	0.12	1.99	0.17
ω -3: ω -6	8.42	0.73	4.05	0.13	5.90	0.13	8.35	0.74	10.53	0.35
SAFA	24.52	3.88	12.77	0.77	15.08	0.33	9.56	0.64	16.53	1.18
MUFA	21.43	3.93	8.72	0.64	12.99	0.36	4.80	0.42	12.16	1.22
PUFA	52.07	8.35	16.31	0.78	17.12	0.60	10.42	0.79	21.98	2.74
LCPUFA	1.83	0.29	0.98	0.06	1.05	0.01	0.64	0.04	1.48	0.03