The following supplement accompanies the article

Trait-mediated indirect interactions among residents of rocky shore tidepools

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Marine Ecology Progress Series 552:31-46 (2016)

SUPPLEMENTARY MATERIAL

Supplement 1: Analysis of variance — Table S1a–h

Analysis of variance tables of laboratory and field experiments with *Tegula funebralis* feeding on microalgae and macroalgae in the presence and absence of *Leptasterias* spp. and *Pisaster ochraceus*.

Table S1a. Cumulative percent consumption of 7 taxa of macroalgae (*Ulva lactuca, Cladophora columbiana, Porphyra* spp., *Pelvetiopsis limitata, Fucus gardneri, Endocladia muricata* and *Mastocarpus papillatus*) by *Tegula funebralis* checked 11 times over 269 h during 12 replicate trials in laboratory tanks.

Treatment	df	F	p
Algae	6	172.04	<0.001
Time	1	596.38	<0.001
Algae x time	6	2.91	0.008
Error	910		

Table S1b. Two-factor ANOVA of the effect of *Leptasterias* spp. and juvenile *Pisaster ochraceus* on microalgae grazed by *Tegula funebralis* over 1 h in the laboratory.

	Leptasterias			*Pisaster*		
Treatment	df	F	p	df	F	p
Snail	1	195.13	<0.001	1	52.32	<0.001
Seastar	1	37.63	<0.001	1	8.46	0.004
Snail x seastar	1	43.23	<0.001	1	8.46	0.004
Error	401			152		

Table S1c. One-factor ANOVA of the effect of *Leptasterias* spp. and juvenile *Pisaster ochraceus* on time out of water by *Tegula funebralis* over 1 h in the laboratory.

	Leptasterias			*Pisaster*		
Treatment	df	F	p	df	F	p
Seastar	1	32.49	<0.001	1	70.09	<0.001
Error	154			100		

Table S1d. One-factor ANOVA of the effect of caged adult *Pisaster ochraceus* on the number of *Tegula funebralis* grazing and the amount of *Ulva lactuca* grazed over 8 h in the laboratory.

Snails grazing				Algae grazed			
Treatment	df	F	p	Treatment	df	F	p
Seastar	1	4.29	0.002	Seastar	1	11.76	<0.001
Error	11			Error	26		

Table S1e. Effect of *Leptasterias* spp. on microalgae grazed, grazing activity and time out of water of small (<12 mm), medium (12-18 mm) and large (>18 mm) *Tegula funebralis* over 1 h in laboratory tanks.

		Leptasterias		
Response	Treatment	df	F	p
Algae grazed	Snail size	3	24.39	<0.001
	Seastar	1	83.21	<0.001
	Size x seastar	3	8.15	<0.001
	Error	165		
Snails grazing	Snail size	2	1.34	0.265
	Seastar	1	112.91	<0.001
	Size x seastar	2	1.89	0.155
	Error	150		
Snails out of water	Snail size	2	1.25	0.290
	Seastar	1	154.31	< 0.001
	Size x seastar	2	1.69	0.188
	Error	150		

Table S1f. Effect of *Leptasterias* spp. on microalgae grazed, grazing activity and tine out of water for starved or fed *Tegula funebralis* for 1 week and then exposed to seastars over 1 h in laboratory tanks.

		Leptasterias		
Response	Treatment	df	F	p
Algae grazed	Snail hunger	2	90.70	<0.001
	Seastar	1	33.93	<0.001
	Hunger x seastar	2	2.36	0.097
	Error	219		
Snails grazing	Snail hunger	1	60.88	< 0.001
	Seastar	1	71.39	< 0.001
	Hunger x seastar	1	3.44	0.065
	Error	198		
Snails out of water	Snail hunger	1	8.14	0.005
	Seastar	1	137.94	< 0.001
	Hunger x seastar	1	0.22	0.640
	Error	198		

Table S1g. Two-factor ANOVA of the effect of waterborne cues from adult *Pisaster ochraceus* on microalgae and *Ulva lactuca* grazed by *Tegula funebralis* 0 - 15 cm, 60 - 75 cm and 120 - 135 cm away on flowthrough seawater tables for 16 h in the laboratory. Degrees of freedom used for the numerator (num) and denominator (den) are listed because the spit plot design necessitates different error degrees of freedom (denominator) for each term in the model.

	Microalgae			*Ulva*		
Treatment	df (num, den)	F	p	df (num, den)	F	p
Seastar	1, 27.12	49.36	<0.001	1, 26.96	19.09	<0.001
Distance	3, 27.58	65.17	<0.001	3, 28.29	4.34	0.012
Seastar x distance	3, 27.12	13.27	<0.001	3, 26.97	2.91	0.053

Table S1h. One-factor ANOVA of the effect of *Leptasterias* spp. on microalgae grazed and *Tegula funebralis* out of water and *Pisaster ochraceus* on snails grazing *Ulva lactuca* grazed and out of water in tidepools for ~5 h.

		Leptasterias			*Pisaster*			
Factor	Treatment	df	F	p	Factor	df	F	p
Algae grazed	Seastar	1	1.81	0.20	Grazing	1	0.47	0.499
	Error	14				24		
Out of water	Seastar	1	11.24	0.002	Out of water	1	18.28	<0.001
	Error	38				39		

Supplement 2: Initial size and hunger experiments

Using the data from the 1-hour experiments with *Leptasterias* spp. and juvenile *Pisaster ochraceus*, we examined whether small (≤ 13 mm diameter) or large *Tegula funebralis* (14 – 40 mm) reacted differently to each predator and if snail size affected the strength of trait-mediated indirect interactions (TMII). For *Leptasterias* spp. experiments, we conducted 82 and 41replicate trials in mesocosms for large and small snails, respectively, and we recorded algae grazed for 64 of the replicates and tine out of water for 44 of the replicates. For experiments with juvenile *P. ochraceus*, we conducted 30 and 27 replicated trials for large and small snails, respectively. We also examined whether snails held for 3 d without food or snails collected the day of the experiment reacted differently to *Leptasterias* spp. (n = 14 and 13 for starved and fed snails, respectively, and n = 27 for algae grazed and n = 12 for time out of water). We also conducted seastar only and no seastar controls (n = 9 each). Data were analyzed using separate 2-factor analysis of variance (ANOVA) to determine the main interactive effects of snail treatment (size and hunger) and seastar treatment (present or absent) on the proportion of microalgae grazed and time spent out of water following arcsine square-root transformation of data.

Neither size nor hunger accounted for the collective responses of snails to seastars. Small snails grazed and fled from the water as much as large snails in response to both *Leptasterias* spp. (Fig. S1a, Table S2a; grazing: Snail size: $F_{(1,1)} = 9.5, p = 0.002$; Seastar treatment: $F_{(1,238)} = 26.9, p < 0.001$; Seastar treatment x Snail size: $F_{(1,238)} = 1.6, p = 0.209$; habitat shift: Snail size: $F_{(1,1)} = 0.7, p = 0.390$; Seastar treatment: $F_{(1,238)} = 88.2, p < 0.001$; Seastar treatment x Snail size: $F_{(1,238)} = 0.2, p = 0.628$) and juvenile *Pisaster ochraceus* (grazing: Snail size: $F_{(1,1)} = 2.1, p = 0.154$; Seastar treatment: $F_{(1,110)} = 41.8, p < 0.001$; Seastar treatment x Snail size: $F_{(1,110)} = 1.6, p = 0.253$; habitat shift: Snail size: $F_{(1,1)} = 0.3, p = 0.0.588$; Seastar treatment: $F_{(1,110)} = 151.9, p < 0.001$; Seastar treatment x Snail size: $F_{(1,110)} = 0.3, p = 0.576$).

Starved snails grazed and fled from the water as much as fed snails in response to *Leptasterias* spp. (Fig. S1b, Table S2b; grazing: Snail hunger: $F_{(1,1)} = 2.8, p = 0.104$; Seastar treatment: $F_{(1,50)} = 7.9, p = 0.007$; Seastar treatment x Snail hunger: $F_{(1,50)} < 0.1, p = 0.989$; habitat shift: Snail hunger: $F_{(1,1)} = 0.4, p = 0.539$; Seastar treatment: $F_{(1,20)} = 3.9, p = 0.062$; Seastar treatment x Snail hunger: $F_{(1,20)} = 0.8, p = 0.378$). Hunger trials were not conducted with *Pisaster ochraceus*.

Table S2a. Effect of *Leptasterias* spp. and juvenile *Pisaster ochraceus* on microalgae grazed and time out of water of small (≤ 13 mm) and large (>13 mm) *Tegula funebralis* in seawater tanks in the laboratory over 1h.

		Leptasterias			*Pisaster*		
	Treatment	df	F	p	df	F	p
Algae grazed	Snail size	1	9.53	0.002	1	2.06	0.154
	Seastar	1	26.87	<0.001	1	41.82	<0.001
	Size x seastar	1	1.59	0.209	1	1.32	0.253
	Error	238			110		
Out of water	Snail size	1	0.74	0.390	1	0.30	0.588
	Seastar	1	88.18	<0.001	1	151.89	<0.001
	Size x seastar	1	0.24	0.628	1	0.31	0.576
	Error	238			110		

Table S2b. Effect of *Leptasterias* spp. on algae grazed and time out of water of starved and fed *Tegula funebralis* in seawater tanks in the laboratory over 1h.

		Leptasterias		
	Treatment	df	F	p
Algae grazed	Snail hunger	1	2.75	0.104
	Seastar	1	7.91	0.007
	Hunger x seastar	1	<0.001	0.989
	Error	50		
Out of water	Snail hunger	1	0.39	0.539
	Seastar	1	3.92	0.062
	Hunger x seastar	1	0.81	0.378
	Error	20		

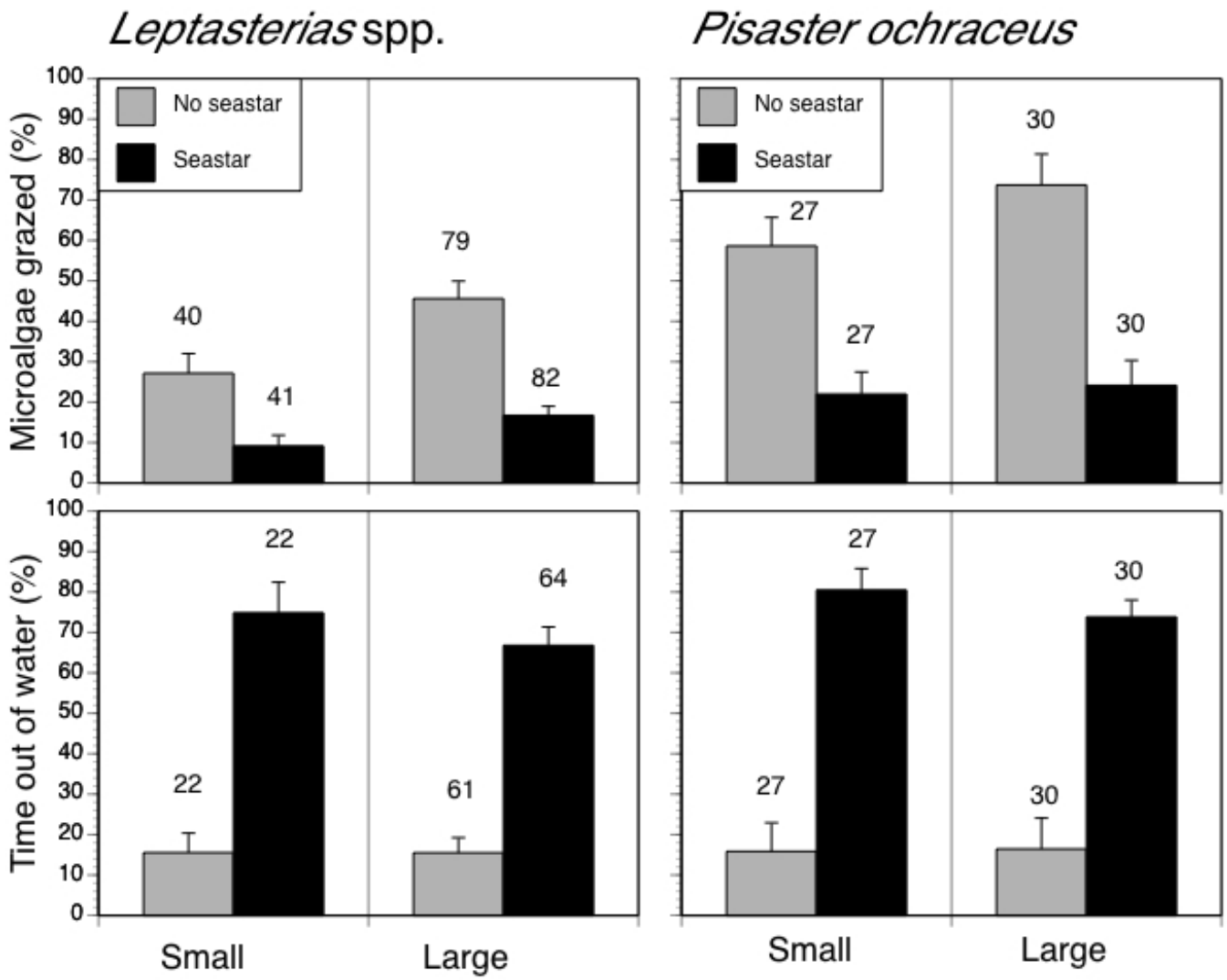

Fig. S1a. *Tegula funebralis* size in the laboratory. Mean (± 1 SE) proportion of microalgae grazed (top) and time spent out of the water (bottom) by small (≤ 13 mm diameter) and large (> 13 mm diameter) *T. funebralis* in the presence and absence of *Leptasterias* spp. (left) and juvenile *Pisaster ochraceus* (right) after 1 h in the laboratory.

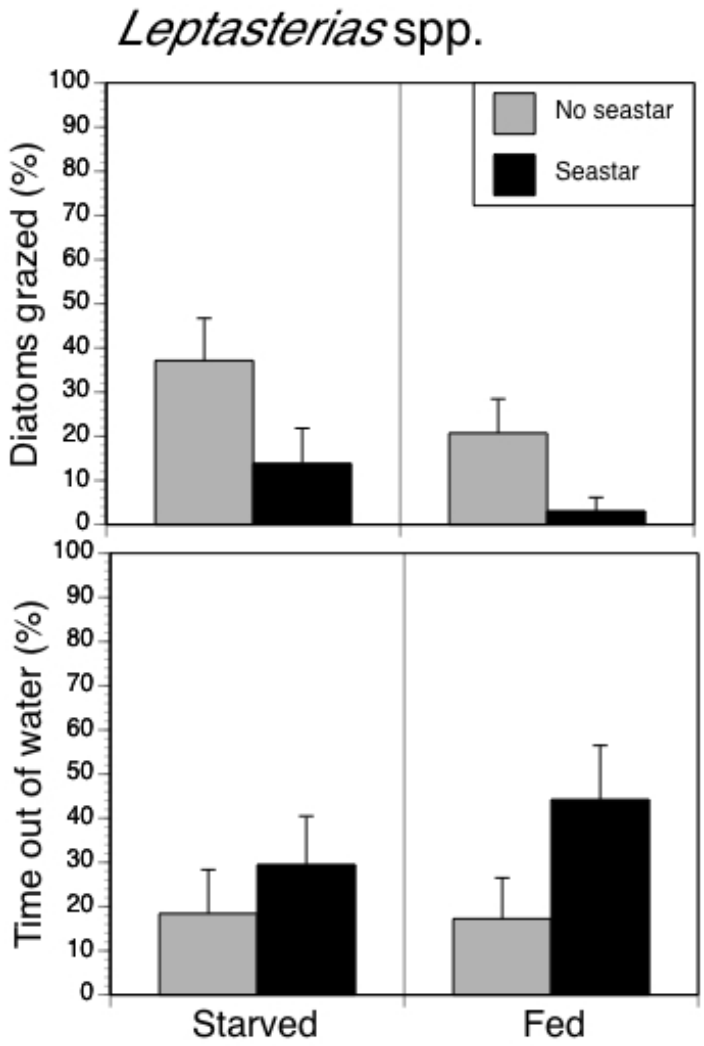

Fig. S1b. *Tegula funebralis* hunger in the laboratory. Mean (± 1 SE) proportion of microalgae grazed (top) and time spent out of the water (bottom) by starved (≥ 24 h) and newly collected (< 24 h) *T. funebralis*) in the presence (n = 13) and absence (n = 14) of predatory *Leptasterias* spp. after 1 h in the laboratory.