Shore-level size gradients and thermal refuge use in the predatory sea star *Pisaster ochraceus*: the role of environmental stressors

Cristián J. Monaco*, David S. Wethey, Shadow Gulledge, Brian Helmuth

*Corresponding author: cristianmonaco@gmail.com

Table S1. Results of multiple regression analyses (conducted through generalized linear models, GLM) to test the effect of environmental variables (air temperature, solar radiation, seawater temperature, wind speed, and wave height, measured 1 day before the population surveys) on *Pisaster* shore-level size gradients. The response variable, shore-level size gradient, was the slope of the relationships between intertidal height and *Pisaster* body size on each sample date, and weighed by its associated SE. The significance of parameter estimates was computed via Likelihood Ratio Tests (LRT) using Type II sums of squares. The analysis was run separately for individuals found sun-exposed and heat-protected.

| Refuge use/ Variable	Estimate	Std. Error	χ^2	df	P-value
Heat-protected individuals					
Solar radiation	$-1.4 \cdot 10^{-5}$	$6.4 \cdot 10^{-5}$	0.05	1	0.83
Air temperature	$4.0 \cdot 10^{-3}$	$1.3 \cdot 10^{-2}$	0.09	1	0.76
Wave height	$-5.6 \cdot 10^{-3}$	$8.8 \cdot 10^{-3}$	0.41	1	0.52
Seawater temperature	$6.6 \cdot 10^{-4}$	$1.2 \cdot 10^{-2}$	0.003	1	0.96
Wind speed	$-5.4 \cdot 10^{-4}$	$6.9 \cdot 10^{-3}$	0.006	1	0.94
Sun-exposed individuals					
Solar radiation	$-7.7 \cdot 10^{-5}$	$5.4 \cdot 10^{-5}$	2.02	1	0.16
Air temperature	$2.5 \cdot 10^{-2}$	$1.3 \cdot 10^{-2}$	1.33	1	0.25
Wave height	$-8.7 \cdot 10^{-3}$	$1.0 \cdot 10^{-2}$	0.75	1	0.39
Seawater temperature	$2.5 \cdot 10^{-2}$	$1.6 \cdot 10^{-2}$	2.59	1	0.11
Wind speed	$8.5 \cdot 10^{-3}$	$7.8 \cdot 10^{-3}$	1.20	1	0.27
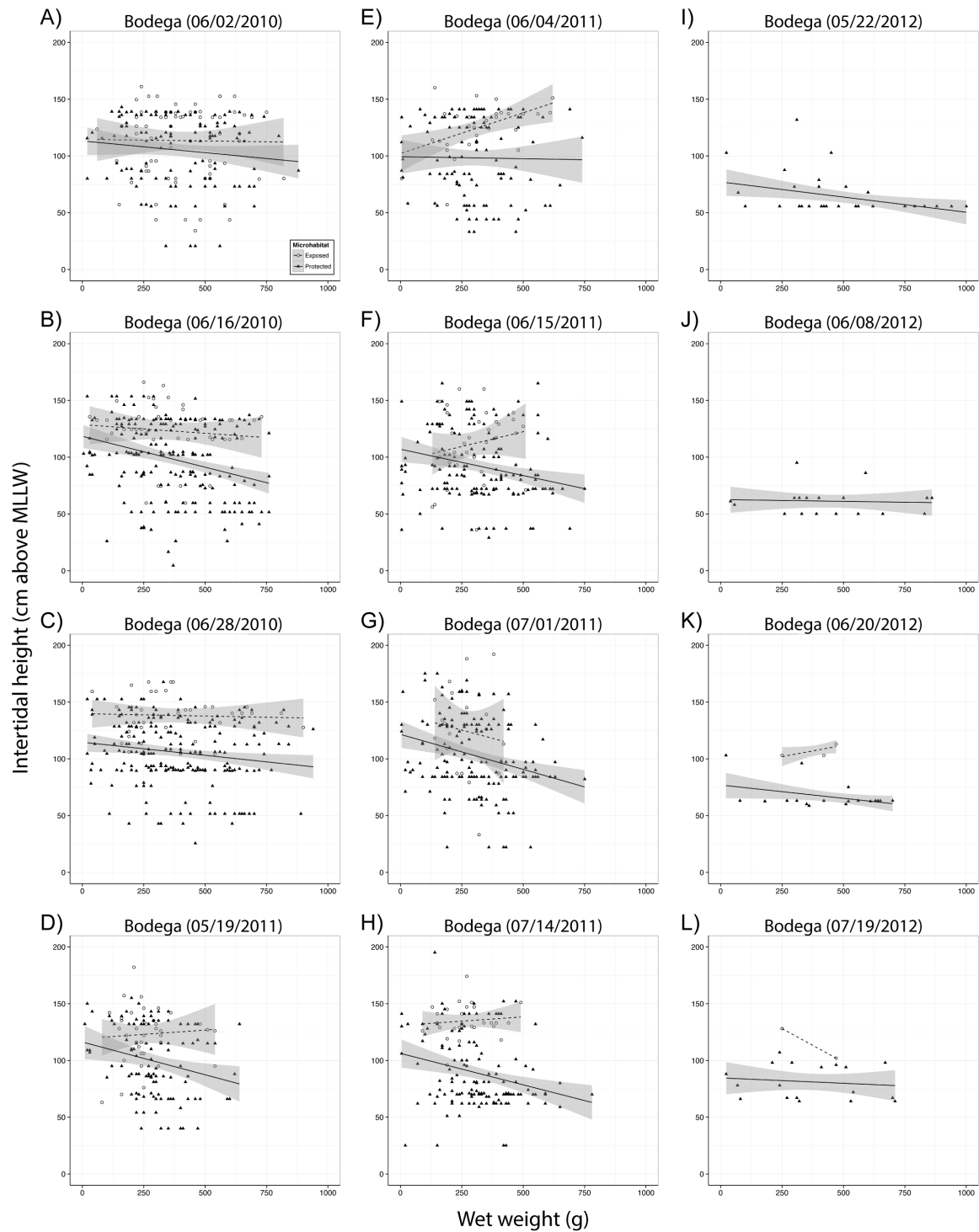
Figure S1. Relationships between *Pisaster* intertidal height (cm) and body size (wet weight) for the surveys conducted during different tide periods at Bodega. Data were grouped as heat-protected or sun-exposed, depending on whether individuals were protected from direct heat and solar radiation. Regression lines and standard errors (shaded areas), as estimated by GLM (with gamma error distribution), are provided. Panels A through C show data from surveys performed in 2010, D through H data from 2011, and I through L data from 2012. Dates are expressed as mm/dd/yyyy.
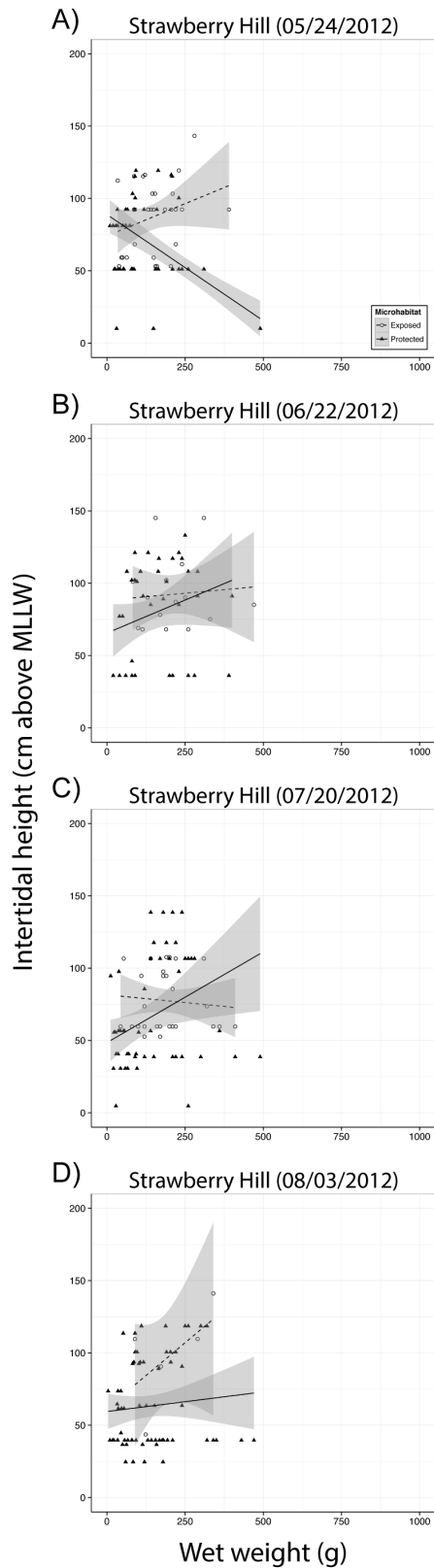
Figure S2. Relationships between *Pisaster* intertidal height (cm) and body size (wet weight) for the surveys conducted during different tide periods at Strawberry Hill. Data were grouped as heat-protected or sun-exposed, depending on whether individuals were protected from direct heat and solar radiation. Regression lines and standard errors (shaded areas), as estimated by GLM (with gamma error distribution), are provided. Panels A through D show data from surveys performed in 2012. Dates are expressed as mm/dd/yyyy. Axes scales are the same as in Fig. S1.