The following supplement accompanies the article

Whelk predators exhibit limited population responses and community effects following disease-driven declines of the keystone predator *Pisaster ochraceus*

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Table S1. Two-way ANOVAs testing the effect of whelk removal treatments and site on the number of cumulative whelks in plots. Because the cumulative numbers were non-independent over time, we modeled each time period separately. Non-significant interaction terms were dropped in models. Time 0 represents the first monitoring prior to removal in June 2014.

	Estimate	**Df**	**Sum Sq**	**Mean Sq**	**F value**	**p-value**
Time 0 (June 2014)						
Site	YB - SH = 16.6	1	2756	2755.6	0.7203	0.4015
Treat	C - W = 0.8	1	6	6.4	0.0017	0.9676
Residuals		37	141554	3825.8		
Time 1 (September 2014)						
Site	YB - SH = 91.8	1	84272	84272	1.8516	0.1818
Treat	C - W = 264.8	1	701190	701190	15.4063	**0.0004**
Residuals		37	1683987	45513		
Time 2 (February 2015)						
Site	YB - SH = -3.9	1	2146	2146	0.0358	0.8510
Treat	C - W = 215.8	1	463579	463579	7.726	**0.0085**
Residuals		37	2220104	60003		
Time 3 (May 2015)						
Site	YB – SH = -10.5	1	1092	1092	0.0121	0.9132
Treat	C – W = 260.0	1	675740	675740	7.4602	**0.0096**
Residuals		37	3351431	90579		

Table S2. ANOVA (analysis of deviance) tables for models explaining effect of treatment, time point, and site on the change in cover of the primary space-occupying prey species. Results are from mixed effects models (GLMM). Type III ANOVAs were run when interactions were present.

Species	**Term**	**X^2**	**Df**	**p-value**
B. glandula	Intercept	8.258	1	**0.0041**
	Time	40.60	2	**<0.0001**
	Site	0.5882	1	0.44
	Treatment	0.0016	1	0.97
	Time x Site	0.2495	2	0.88
	Time x Treatment	0.0894	2	0.96
	Site x Treatment	4.829	1	**0.028**
	Time x Site x Treatment	9.018	2	**0.011**
C. dalli	Intercept	5.907	1	**0.015**
	Time	85.37	2	**<0.0001**
	Site	11.97	1	**0.00054**
	Time x Site	20.69	2	**<0.0001**
M. californianus	Intercept	963.8	1	**<0.0001**
	Time	96.24	2	**<0.0001**
	Site	0.0608	1	0.81
	Treatment	4.088	1	**0.043**
	Time x Site	11.15	2	**0.0038**
M. trossulus	Intercept	29.69	1	**<0.0001**
	Time	56.31	2	**<0.0001**
	Site	2.157	1	0.14
	Time x Site	17.24	2	**0.00018**
P. polymerus	Intercept	370.3	1	**<0.0001**
	Time	94.70	2	**<0.0001**
	Site	1.320	1	0.25
	Time x Site	16.29	2	**0.00030**
S. cariosus	Intercept	675.5	1	**<0.0001**
	Time	11.50	2	**0.0032**
	Site	8.911	1	**0.0028**

Table S3. Effect of treatment, time point, and site on the change in cover of the primary space-occupying prey species. Results are from mixed effects models (GLMM) with only fixed effects presented. The reference groups are: control for treatment, time 1 for Sept. 2014, and Strawberry Hill (SH) for site. YB=Yachats Beach, Time 2 = Feb. 2015, Time 3=May 2015.

Species	Term	Value	Std.Error	DF	t-value	p-value
B. glandula	Intercept	0.102	0.0355	72	2.87	**<0.01**
	Time 2	-0.157	0.0310	72	-5.06	**<0.001**
	Time 3	-0.183	0.0310	72	-5.88	**<0.001**
	Site YB	-0.0385	0.0502	36	-0.767	0.45
	Trmt whelk removal	-0.002	0.0502	36	-0.0398	0.97
	Time 2:Site YB	-0.02	0.0439	72	-0.456	0.65
	Time 3:Site YB	-0.00225	0.0439	72	-0.0513	0.96
	Time 2:Trmt whelk removal	0.005	0.0439	72	0.114	0.91
	Time 3:Trmt whelk removal	0.0130	0.0439	72	0.296	0.77
	Site YB:Trmt whelk removal	0.156	0.0710	36	2.20	**0.035**
	Time 2:Site YB:Trmt whelk removal	-0.158	0.0620	72	-2.55	**0.013**
	Time 3:Site YB:Trmt whelk removal	-0.165	0.0620	72	-2.65	**<0.01**
C. dalli	Intercept	0.0378	0.0155	76	2.43	**0.017**
	Time 2	-0.0868	0.0124	76	-6.98	**<0.001**
	Time 3	-0.109	0.0124	76	-8.73	**<0.001**
	Site YB	-0.0760	0.0220	38	-3.46	**<0.01**
	Time 2:SiteYB	0.0533	0.0176	76	3.03	**<0.01**
	Time 3:SiteYB	0.0783	0.0176	76	4.45	**<0.001**
M. californianus (logit transformed)	Intercept	-4.32	0.139	76	-31.0	**<0.001**
	Time 2	0.534	0.109	76	4.88	**<0.001**
	Time 3	1.07	0.109	76	9.81	**<0.001**
	Site YB	0.0417	0.169	37	0.247	0.81
	Trmt whelk removal	-0.290	0.143	37	-2.02	0.050
	Time 2:Site YB	-0.181	0.155	76	-1.17	0.25
	Time 3:Site YB	-0.509	0.155	76	-3.29	**<0.01**
M. trossulus	Intercept	-0.228	0.0419	76	-5.45	**<0.001**
	Time 2	-0.0652	0.0269	76	-2.42	**0.018**
	Time 3	-0.198	0.0269	76	-7.36	**<0.001**
	Site YB	-0.0870	0.0592	38	-1.47	0.15
	Time 2:Site YB	0.157	0.0381	76	4.13	**0.0001**
	Time 3:Site YB	0.0661	0.0381	76	1.74	0.086
P. polymerus (logit transformed)	Intercept	-3.25	0.169	76	-19.2	**<0.001**
	Time 2	1.05	0.162	76	6.51	**<0.001**
	Time 3	1.54	0.162	76	9.52	**<0.001**
	Site YB	-0.275	0.239	38	-1.15	0.26
	Time 2:Site YB	-0.619	0.229	76	-2.70	**<0.01**
	Time 3:Site YB	-0.905	0.229	76	-3.95	**<0.001**
S. cariosus (logit transformed)	Intercept	-4.16	0.160	78	-26.0	**<0.001**
	Time 2	0.179	0.0771	78	2.32	**0.023**
	Time 3	0.254	0.0771	78	3.30	**<0.01**
	Site YB	0.649	0.218	38	2.99	**<0.01**

Table S4. Negative binomial regression results for *N. canaliculata* density over time when *M. trossulus* zone quadrats are included and excluded. The reference site was SH. BB and FC sites are on Cape Foulweather, while YB and SH are on Cape Perpetua.

With *M. trossulus* quadrats *Residual deviance: 596.9 on 632, df, theta=0.1787				
Parameter	**Estimate**	**Std. Error**	**z value**	**p-value**
Intercept	20.80	9.625	2.16	**0.0307**
Site BB	-0.3875	0.2579	-1.502	0.1330
Site FC	-0.7212	0.2735	-2.637	**0.0084**
Site YB	0.4755	0.2505	1.898	**0.0577**
Time	-0.0011	0.0006	-1.869	0.0616
Without *M. trossulus* quadrats *Residual deviance: 548.3 on 596, df, theta=0.1768				
Parameter	**Estimate**	**Std. Error**	**z value**	**p-value**
Intercept	13.14	9.969	1.318	0.1873
Site BB	-0.4299	0.2780	-1.547	0.1220
Site FC	-0.7750	0.2925	-2.649	**0.0081**
Site YB	-0.3923	0.2661	-1.474	0.1404
Time	-0.0006294	0.0006095	-1.033	0.3018

Table S5. Negative binomial regression results for *N. ostrina* density over time. In this analysis results were the same whether or not *M. trossulus* quadrats were included, so we have only shown regression with the full analysis. The reference site was SH. BB and sites are on Cape Foulweather, while YB and SH are on Cape Perpetua.

With *M. trossulus quadrats* *Residual deviance: 733.81 on 632, df, theta=0.3431				
Parameter	**Estimate**	**Std. Error**	**z value**	**p-value**
Intercept	-13.2	6.93	-1.908	**0.0564**
Site BB	-2.07	0.186	-11.128	**<0.0001**
Site FC	-1.67	0.197	-8.497	**<0.0001**
Site YB	-0.0819	0.180	-0.454	0.650
Time	0.0011	0.0004	2.597	**0.0094**

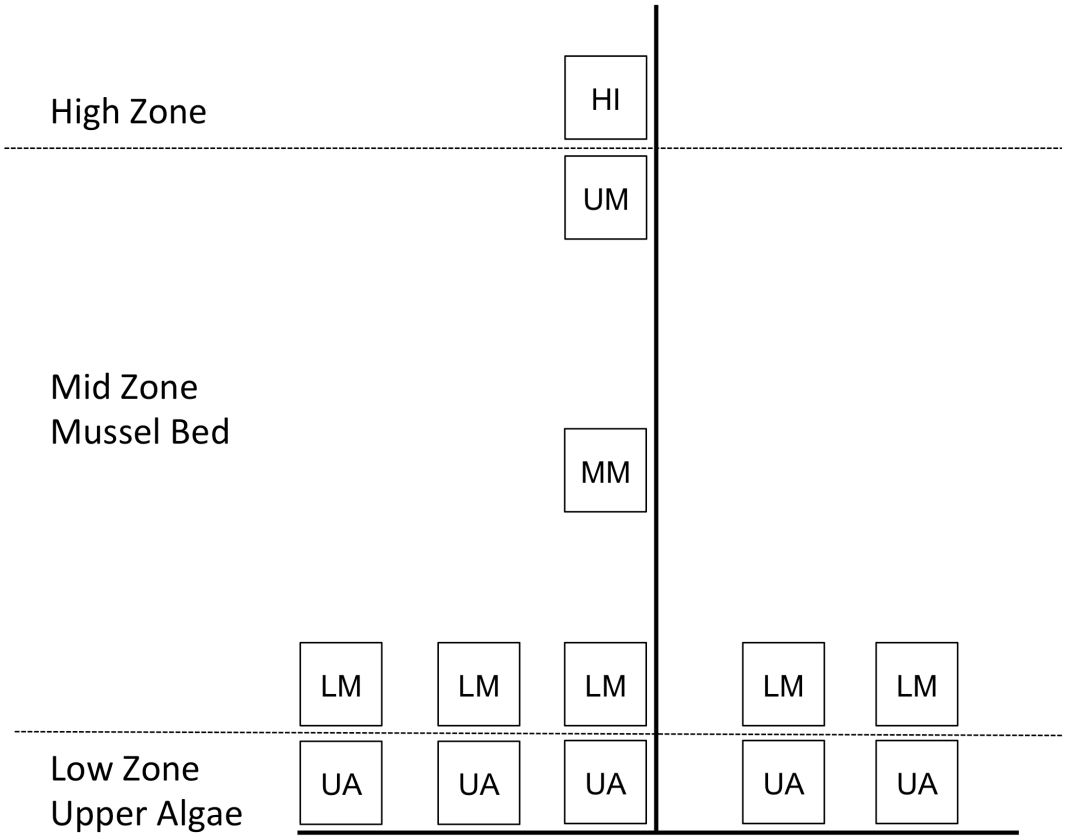

Figure S1. Survey transect design to measure the abundance and distribution of whelks at 4 study sites. The main transect line is vertical with additional horizontal quadrats placed in the upper algal zone (UA) and at the lower edge of the mussel bed (LM). There were five replicate transect lines at each site). The other zones were middle of mussel bed (MM), upper edge of mussel bed (UM), and the high zone (HI).

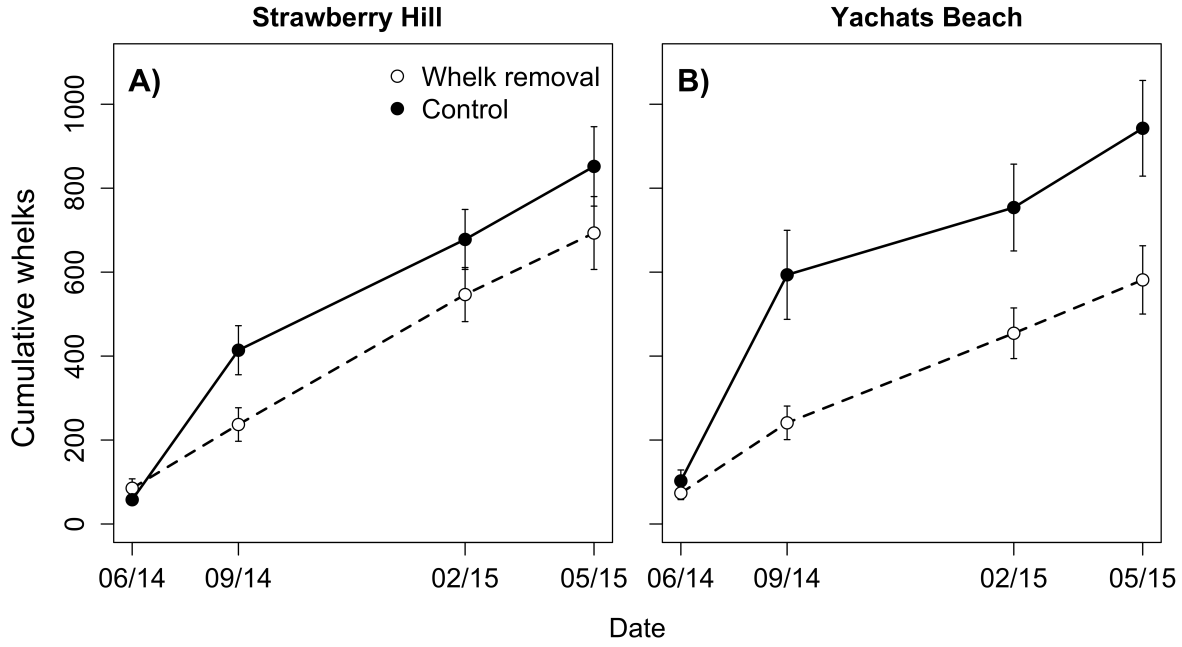

Figure S2. Total cumulative whelk densities (individuals m^{-2}) over the course of the experiment for whelk removals (dashed lines) and controls (solid lines) at Strawberry Hill (SH, left panel) and Yachats Beach (YB, right panel). Whelk removals reduced overall whelk presence. Cumulative densities are calculated using all monitoring data, but only time points that match prey abundance data are displayed. Whelks were recorded by species and pooled for analysis. Error bars are 1 SE.

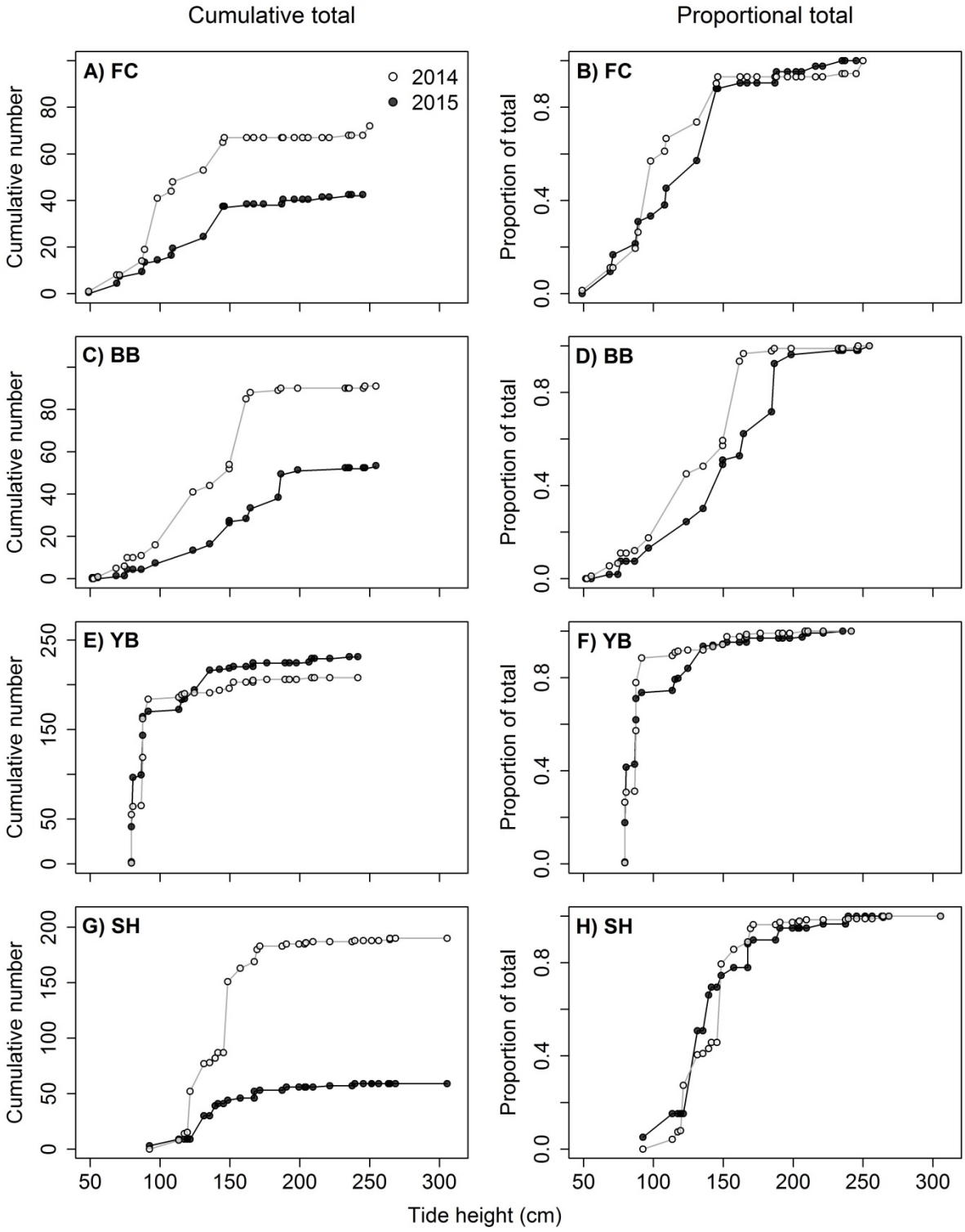

Figure S3. Abundance of *N. canaliculata* across tide heights (cm above MLLW) for July 2014 (white) and July 2015 (black). Left panel shows cumulative numbers of whelks with increasing tidal height. Right panel is cumulative proportion of total whelks with tidal height. Each row is a different site, with FC and BB occurring on Cape Foulweather, and YB and SH on Cape Perpetua.

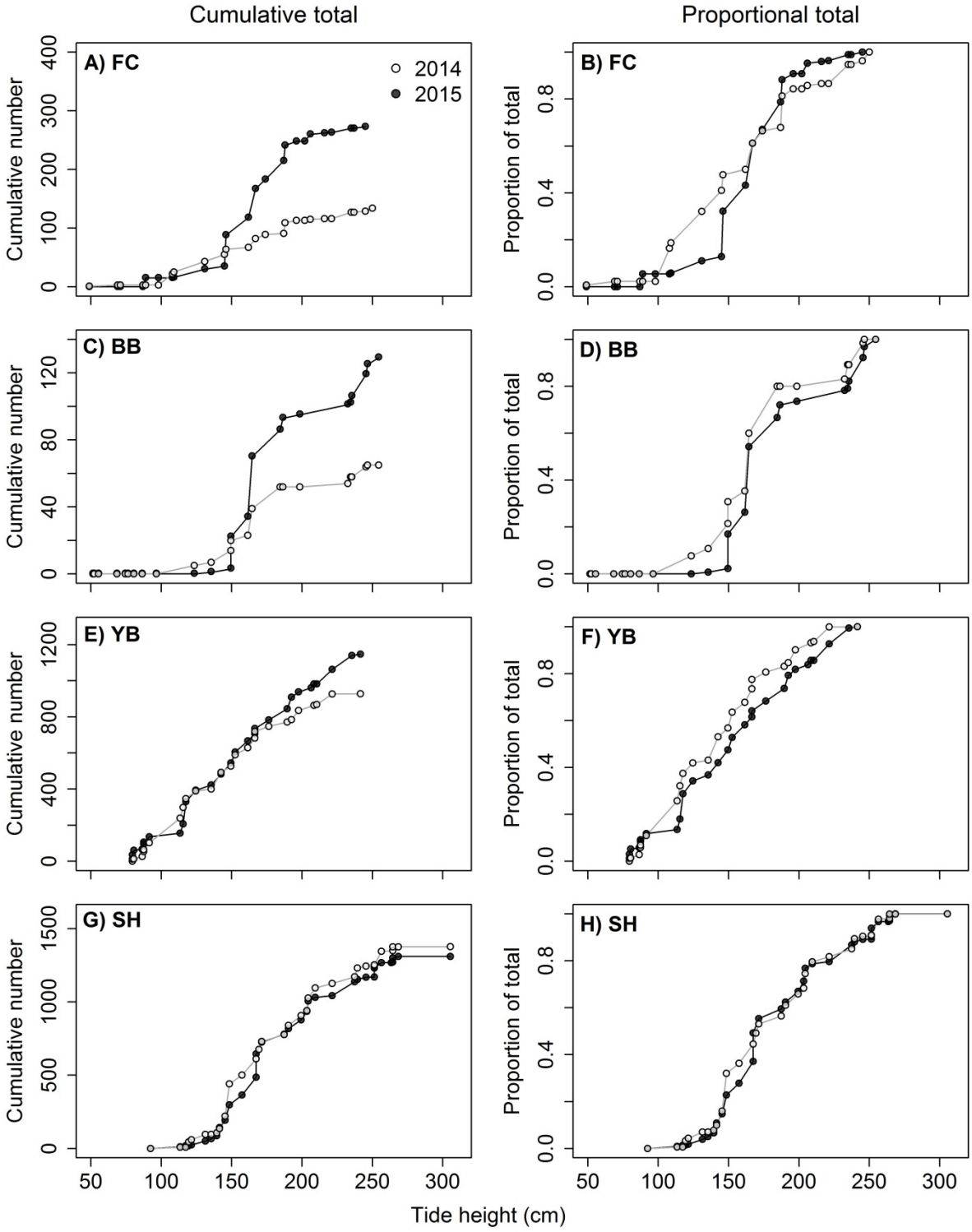

Figure S4. Abundance of *N. ostrina* across tide heights (cm above MLLW) for July 2014 (white) and July 2015 (black). Left panel shows cumulative numbers of whelks with increasing tidal height. Right panel is cumulative proportion of total whelks with tidal height. Each row is a different site, with FC and BB occurring on Cape Foulweather, and YB and SH on Cape Perpetua.