

Potential backfiring effects of Marine Protected Areas on kelp herbivory

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Supplementary Figure 1 - Stainless-steel chain with 10 pieces of different kelp attached with pegs (5 of *L. ochroleuca* and 5 of *S. polyschides*).



Supplementary Figure 2 - Bite marks in kelp pieces from *L. ochroleuca* and *S. polyschides*. A regular, round pattern characterises fish bitemarks, while urchin bitemarks are irregular.

Supplementary Table S1 - Results of Generalized linear mixed models (glmmTMB) for differences in herbivory occurrence and % of consumed biomass between sites, depths, kelp species and grazers.

A. Herbivory– Occurrence (Fig.1 of the main document)	B. Herbivory - % of consumed biomass (Fig. 2, Fig.3, Fig.4 of the main document)																																																
Best suited model: Null Herbivory ~ Site + Depth + Kelp + (1 Site/Reef) + (1 Season), family = binomial link = "logit"	Best suited model: % of consumed biomass ~ Site + Depth + Grazer + Kelp + Site:Depth + Grazer:Kelp + Depth:Kelp + (1 Site/Reef) + (1 Season) family = Gamma link = "log"																																																
Analysis of Deviance Table (Type II Wald chisquare tests) <table border="1"> <thead> <tr> <th></th> <th>Chisq</th> <th>Df</th> <th>P</th> </tr> </thead> <tbody> <tr> <td>Site</td> <td>7.5543</td> <td>1</td> <td>0.005987 **</td> </tr> <tr> <td>Depth</td> <td>5.8969</td> <td>1</td> <td>0.015168 *</td> </tr> <tr> <td>Kelp</td> <td>42.5301</td> <td>1</td> <td>6.96e-11 ***</td> </tr> </tbody> </table> --- Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1		Chisq	Df	P	Site	7.5543	1	0.005987 **	Depth	5.8969	1	0.015168 *	Kelp	42.5301	1	6.96e-11 ***	Analysis of Deviance Table (Type II Wald chisquare tests) <table border="1"> <thead> <tr> <th></th> <th>Chisq</th> <th>Df</th> <th>P</th> </tr> </thead> <tbody> <tr> <td>Site</td> <td>4.1212</td> <td>1</td> <td>0.04235 *</td> </tr> <tr> <td>Depth</td> <td>61.9081</td> <td>1</td> <td>3.599e-15 ***</td> </tr> <tr> <td>Grazer</td> <td>30.0765</td> <td>1</td> <td>4.153e-08 ***</td> </tr> <tr> <td>Kelp</td> <td>27.2369</td> <td>1</td> <td>1.800e-07 ***</td> </tr> <tr> <td>Site:Depth</td> <td>31.9984</td> <td>1</td> <td>1.543e-08 ***</td> </tr> <tr> <td>Grazer:Kelp</td> <td>5.1063</td> <td>1</td> <td>0.02384 *</td> </tr> <tr> <td>Depth:Kelp</td> <td>3.3307</td> <td>1</td> <td>0.06800 .</td> </tr> </tbody> </table> --- Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1		Chisq	Df	P	Site	4.1212	1	0.04235 *	Depth	61.9081	1	3.599e-15 ***	Grazer	30.0765	1	4.153e-08 ***	Kelp	27.2369	1	1.800e-07 ***	Site:Depth	31.9984	1	1.543e-08 ***	Grazer:Kelp	5.1063	1	0.02384 *	Depth:Kelp	3.3307	1	0.06800 .
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Supplementary Table S2 - Results of Generalized linear mixed models (glmmTMB) for differences in grazer bitemarks frequency between sites, depths, kelp species and grazer.

Herbivory – Grazer frequency (Fig.5 of the main document)			
Best suited model: Grazer frequency ~ Site + Depth + Kelp			
family = negative binomial			
link= "log"			
Analysis of Deviance Table (Type II Wald chisquare tests)			
	Chisq	Df	P
Site	19.2873	1	1.125e-05 ***
Depth	0.8352	1	0.3608
Kelp	0.2468	1	0.6193

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1			

Supplementary Table S3. Results of Generalized linear mixed models (glmmTMB) for differences in fish and urchin abundance between sites and depths captures in Underwater Visual Census (UVC) and Diver Operated Videos (DOV).

UVC – Herbivorous Fish (Fig.6 a. and b. of the main document)	UVC – Urchins (Fig.6 c. of the main document)																												
Best suited model: UVC_fish ~ Site + Depth Family= negative binomial Link= "log"	Best suited model: UVC_urchin ~ Site * Depth Family=negative binomial Link= "log"																												
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Supplementary Table S4- Sum (s) and Abundance (MaxN) of herbivorous fish species and urchins obtained in the Underwater Visual Census (UVC) in Summer and Autumn, in both Sites and both Depths

Site	Depth	Summer				Autumn			
		UVC_fish_S	UVC_fish_MaxN	UVC_urchin_S	UVC_urchin_MaxN	UVC_fish_S	UVC_fish_MaxN	UVC_urchin_S	UVC_urchin_MaxN
PEN	Deep	169	41	157	50	40	8	1	1
PEN	Shallow	88	20	423	70	54	11	461	97
MPA-BER	Deep	306	77	15	6	474	123	96	14
MPA-BER	Shallow	237	28	2	1	266	74	2	1

Supplementary Table S5 - Sum (s) and Abundance (MaxN) of herbivorous fish species obtained in the Diver Operated Videos (DOV) in both Sites and both Depths

Site	Depth	DOV_fish_MaxN	DOV_fish_s
PEN	Deep	3	22
PEN	Shallow	5	18
MPA-BER	Deep	50	133
MPA-BER	Shallow	30	142