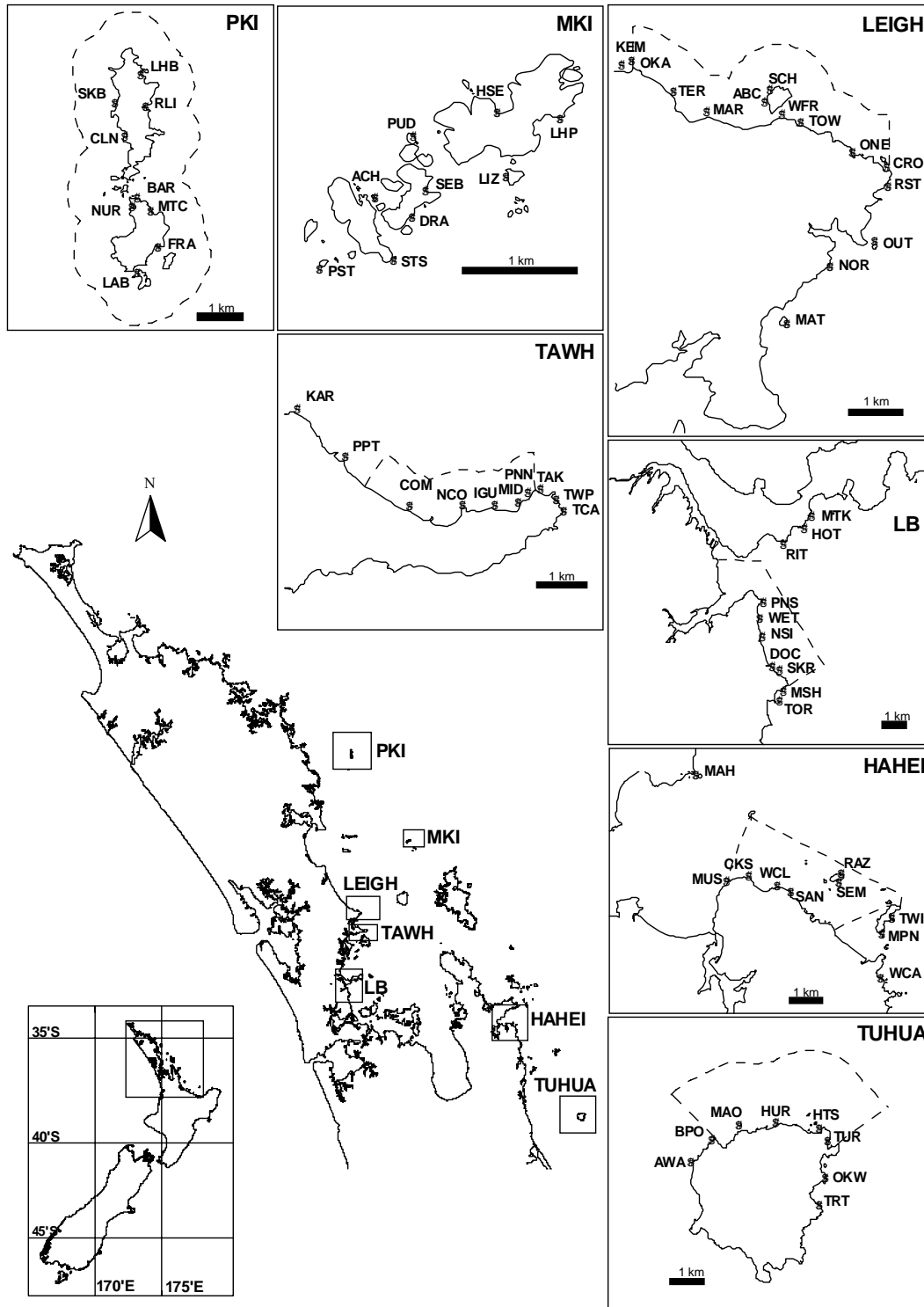


Appendix A - Sampling locations and sites in northeastern New Zealand

PKI=Poor Knights Islands, MKI=Mokohinau Islands, TAWH=Tawharanui and LB=Long Bay. Dashed line indicates boundary of no-take marine reserve in each location. Note: PKI and MKI are treated as a paired reserve/fished location. See Shears and Babcock (2004) for site names, positions and descriptions of benthic communities.

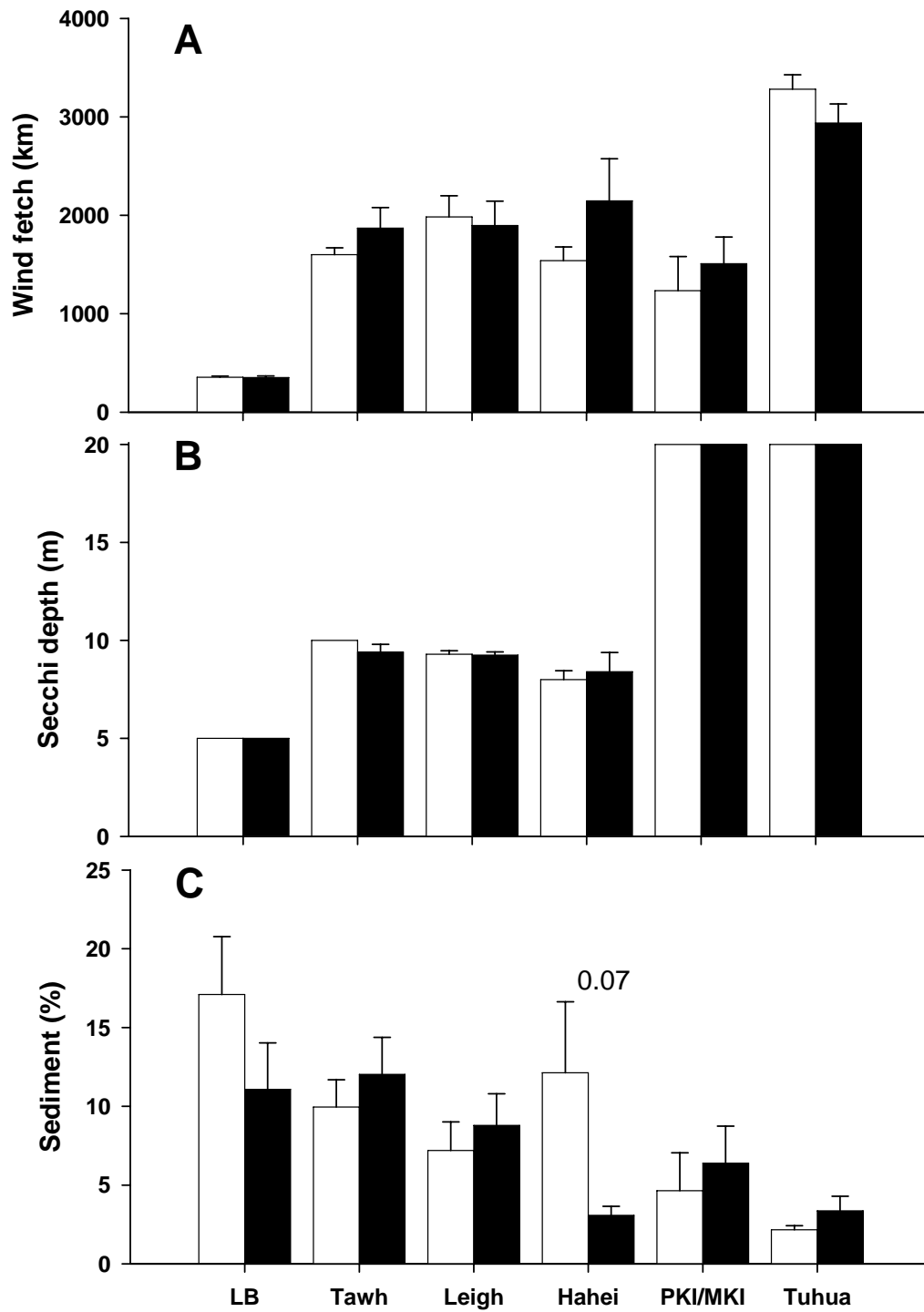


Appendix B(i) Results from mixed model analysis of each environmental variable at reserve and fished sites. Variation in environmental variables: (a) across LOCATION and STATUS, and (b) for STATUS within each location. Models were back-fitted by removing non-significant interaction terms. There was no variation in water clarity measurements among sites at Long Bay, PKI/MKI and Tuhua so these could not be tested (indicated by “X”). Similarly, as single measurements in water clarity and wave exposure were made at each site we could not test for site-level effects.

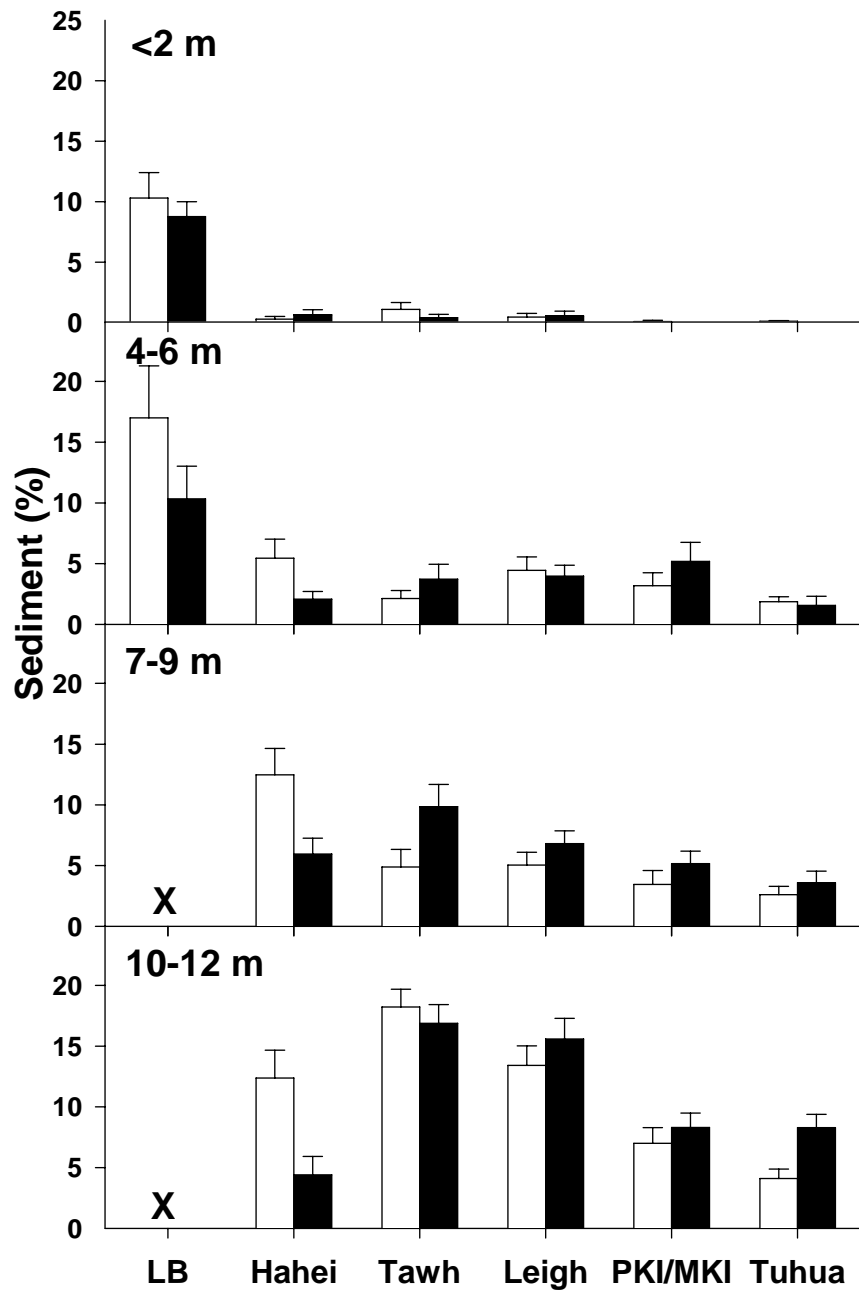
Variable	LOCATION	STATUS	LOCATION*STATUS	SITE(LOCATION*STATUS)
(a)				
<i>Sediment</i>	$F_{5,65}=5.49^{***}$	$F_{1,65}=0.43$	-	0.118 ^{***}
<i>Water clarity</i>	$F_{5,64}=1022.32^{***}$	$F_{1,65}=0.05$	-	X
<i>Wave exposure</i>	$F_{5,64}=17.92^{***}$	$F_{1,65}=0.79$	-	X
(b)				
<i>Sediment</i>	STATUS	SITE(STATUS)		
Long Bay	$F_{1,9}=1.11$ p=0.3199	0.297 p=0.110		
Tawharanui	$F_{1,8}=0.43$ p=0.530	0.040 p=0.327		
Leigh	$F_{1,12}=0.09$ p=0.772	0.299 p=0.044		
Hahei	$F_{1,8}=4.25$ p=0.073	0.695 p=0.054		
PKIMKI	$F_{1,16}=0.45$ p=0.514	1.870 p=0.011		
Tuhua	$F_{1,6}=1.43$ p=0.276	0.1379 p=0.148		
<i>Water clarity</i>	STATUS	SITE(STATUS)		
Long Bay	X	X		
Tawharanui	$F_{1,8}=2.25$ p=0.172	X		
Leigh	$F_{1,13}=0.02$ p=0.887	X		
Hahei	$F_{1,8}=0.14$ p=0.720	X		
PKIMKI	X	X		
Tuhua	X	X		
<i>Wave exposure</i>	STATUS	SITE(STATUS)		
Long Bay	$F_{1,8}=0.01$ p=.923	X		
Tawharanui	$F_{1,8}=1.49$ p=0.256	X		
Leigh	$F_{1,13}=0.07$ p=0.795	X		
Hahei	$F_{1,8}=1.83$ p=0.213	X		
PKIMKI	$F_{1,16}=0.39$ p=0.541	X		
Tuhua	$F_{1,6}=2.02$ p=0.205	X		

Appendix B(ii) – Environmental variation among locations and between reserve (open bars) and fished (shaded bars) sites: Wave exposure (A), water clarity (B) and sediment (C).

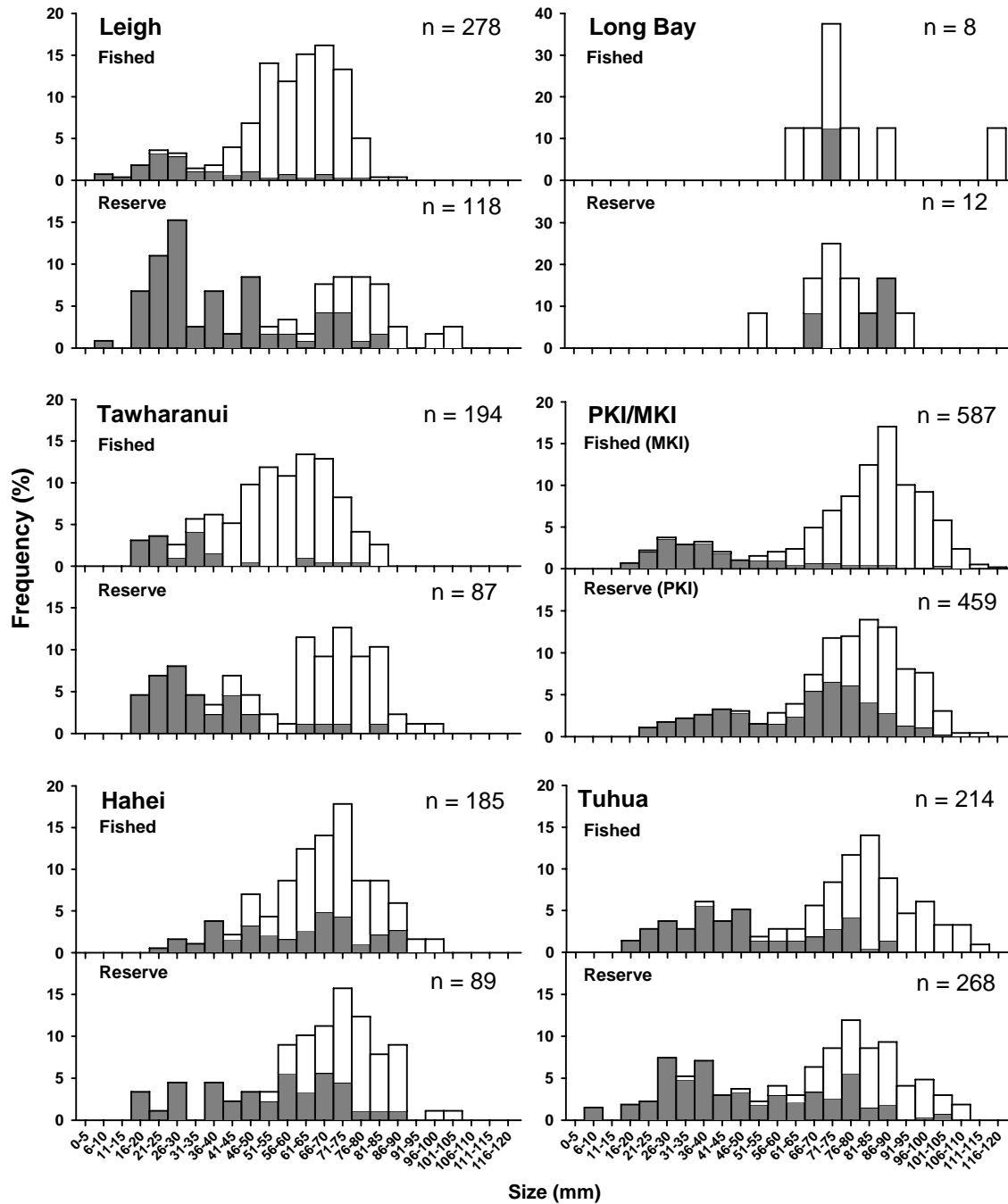
Note: secchi depth was greater than 20 m at all offshore sites, but could not be measured accurately beyond 20 m depth. No significant differences in any of the environmental variables were found between reserve and fished sites.



Appendix B(iii) – Depth related variation in sediment cover (% + SE) among locations and between reserve (open bars) and fished (shaded bars) sites.



Appendix C - Size frequency distribution of *Evechinus* populations fished and reserve sites at each location. Shaded bars indicate the proportion of cryptic individuals, while open bars indicate exposed individuals. *n* indicates the total number of urchins recorded.



Appendix D - Model selection results for exposed sea urchins.

Alternative models explaining the variation in mean urchin density across sites nested within locations based on 3 explanatory variables; wave exposure (fetch), water clarity (secchi) and sediment cover (sed), and fishing (status). Models, with varying numbers of parameters (K), were compared with differences in small sample, bias-corrected Akaike Information Criterion (ΔAIC_c) and normalized Akaike weights (w_i) indicating the weight of evidence in favor of a given model.

Area (depth)	Model	n	K	ΔAIC	w_i	r^2
Leigh (4-6m)	status	15	3	0.00	0.62	0.57
	secchi+status	15	4	3.11	0.13	0.59
	fetch+status	15	4	3.64	0.10	0.57
	sed+status	15	4	3.73	0.10	0.57
	fetch+secchi+status	15	5	6.65	0.02	0.62
Tawharanui (4-6m)	status	10	3	0.00	0.45	0.69
	sed+status	10	4	0.21	0.40	0.83
	secchi+status	10	4	3.23	0.09	0.77
	fetch+status	10	4	5.45	0.03	0.71
	secchi+sed+status	10	5	8.59	0.01	0.84
Hahei (4-6m)	status	10	3	0.00	0.32	0.35
	sed	10	3	1.76	0.13	0.23
	fetch	10	3	2.70	0.08	0.15
	secchi	10	3	4.07	0.04	0.02
	sed+status	10	4	4.61	0.03	0.43
PKI/MKI (4-6m)	status	18	3	0.00	0.31	0.22
	fetch+status	18	4	0.80	0.21	0.32
	sed+status	18	4	1.45	0.15	0.30
	sed	18	3	2.88	0.07	0.08
	fetch	18	3	3.27	0.06	0.06
PKI/MKI (7-9m)	fetch	18	3	0.00	0.38	0.33
	fetch+status	18	4	0.18	0.35	0.44
	fetch+sed	18	4	2.90	0.09	0.35
	status	18	3	3.90	0.05	0.17
	fetch+sed+status	18	5	3.97	0.05	0.44

Appendix E - Model selection results for macroalgal biomass.

Alternative models explaining the variation in mean algal biomass across sites nested within areas based on 3 explanatory variables; exposed urchins (eeve), wave exposure (fetch), water clarity (secchi), and sediment cover (sed). Models, with varying numbers of parameters (K), were compared with differences in small sample, bias-corrected Akaike Information Criterion (ΔAIC_c) and normalized Akaike weights (w_i) indicating the weight of evidence in favor of a given model.

Area (depth)	Model	n	K	ΔAIC	w_i	r^2
Leigh (4-6m)	eeve(-)	15	3	0.00	0.49	0.62
	sed+eeve	15	4	1.44	0.24	0.67
	secchi+eeve	15	4	3.17	0.10	0.63
	Fetch+eeve	15	4	3.22	0.10	0.63
	secchi+sed+eeve	15	5	5.96	0.03	0.68
Tawharanui (4-6m)	Eeve	10	3	0.00	0.71	0.71
	sed+eeve	10	4	2.91	0.17	0.79
	secchi+eeve	10	4	4.92	0.06	0.74
	Fetch+eeve	10	4	6.00	0.04	0.71
	Fetch	10	3	9.70	0.01	0.23
Hahei (4-6m)	Eeve	10	3	0.00	0.34	0.41
	Sed	10	3	1.49	0.16	0.31
	Fetch	10	3	2.21	0.11	0.26
	sed+eeve	10	4	3.97	0.05	0.52
	secchi	10	3	4.06	0.04	0.11
PKI/MKI (4-6m)	Eeve	18	3	0.00	0.43	0.54
	Fetch+eeve	18	4	0.30	0.37	0.61
	Fetch+sed+eeve	18	5	2.50	0.12	0.65
	sed+eeve	18	4	3.35	0.08	0.54
	Sed	18	3	12.96	0.00	0.05
PKI/MKI (7-9m)	Fetch+eeve	18	4	0.00	0.37	0.55
	Fetch	18	3	0.36	0.31	0.45
	Eeve	18	3	1.98	0.14	0.39
	Fetch+sed	18	4	3.59	0.06	0.45
	Fetch+sed+eeve	18	5	3.91	0.05	0.55
Leigh (<2m)	secchi+sed+eeve	15	5	0.00	0.45	0.67
	secchi	15	3	1.93	0.17	0.33
	sed+eeve	15	4	3.68	0.07	0.42
	secchi+eeve	15	4	3.89	0.06	0.41
	Eeve	15	3	4.70	0.04	0.20
PKI/MKI (<2m)	Fetch	17	3	0.00	0.33	0.22
	Eeve	17	3	0.69	0.23	0.19
	Fetch+eeve	17	4	2.39	0.10	0.27
	Fetch+sed	17	4	3.38	0.06	0.23
	sed+eeve	17	4	-46.98	4.01	0.04