

## Supplementary Materials

Table S1. Ground-nesting seabirds of the Mercury Islands and their presence on Korapuki, Atiu/Middle, and Green islands (marked with "X"). At the time of sampling, the recently eradicated island of Ahuahu/Great Mercury had no established ground-nesting seabird colonies.

Seabird species			Atiu/Middle & Green Never invaded	Korapuki Eradicated 30+ yrs ago
Northern diving petrel	Kuaka	<i>Pelecanoides urinatrix urinatrix</i>	X	X
Flesh-footed shearwater	Toanui	<i>Puffinus carneipes</i>	X	X
Fluttering shearwater	Pakaha	<i>Puffinus gavia</i>	X	X
Grey-faced petrel	Oi	<i>Pterodroma macroptera</i>	X	X
Little blue penguin	Kororā	<i>Eudyptula minor</i>	X	X
Little shearwater		<i>Puffinus assimilis</i>	X	X
Pycroft's petrel		<i>Pterodroma pycrofti</i>		X
White-faced storm petrel	Takahikare	<i>Pelagodroma marina</i>	X (rare)	

Table S2. Full linear mixed model descriptions for each macroalgae species including fixed effects, weights, random effects, and sample size.

Macroalgae species	Fixed effects	Weight	Random effects	Sample size
<i>C. flexuosum</i>	Season : Islands Season : Depth Season : Runoff Islands : Depth Wave	Season	Quadrat	66
<i>C. maschalocarpum</i>	Season : Islands Season : Depth Season : Runoff Islands : Depth Wave	Islands	Transect	56
<i>C. plumosum</i>	Season : Islands Season : Depth Season : Runoff Islands : Depth Wave	Season : Islands	Season   Transect	69
<i>E. radiata</i>	Season : Islands Season : Depth Season : Runoff Islands : Depth Wave	Islands	Season   Quadrat	79
<i>V. colensoi</i>	Season : Islands Season : Depth Season : Runoff Islands : Depth Wave		Quadrat	35
<i>X. chondrophylla</i>	Season : Islands Season : Depth Season : Runoff Islands : Depth Wave	Islands : Season	Season   Transect	93

Table S3. Macroalgae species identified within quadrats during SCUBA surveys. Their presence on the study islands is marked with "X".

Macroalgae species	Atiu/Middle & Green Never invaded	Korapuki Eradicated 30+ yrs ago	Ahuahu/Great Mercury Eradicated 2 yrs ago
<i>Arthrocardia sp.</i>	X	X	
<i>Carpophyllum angustifolium</i>	X	X	X
<i>Carpophyllum flexuosum</i>	X	X	X
<i>Carpophyllum maschalocarpum</i>	X	X	X
<i>Carpophyllum plumosum</i>	X	X	X
<i>Champia laingii</i>	X	X	
<i>Curdiea flabellata</i>	X		
<i>Cystophora retroflexa</i>		X	X
<i>Delisea compressa</i>	X	X	
<i>Dictyota kunthii</i>	X	X	X
<i>Dictyota ocellata</i>	X		
<i>Ecklonia radiata</i>	X	X	X
<i>Hormosira banksii</i>			X
<i>Hymenena affinis</i>	X	X	X
<i>Lessonia variegata</i>	X	X	
<i>Melanthalia abscissa</i>	X		X
<i>Nesophila hoggardii</i>	X	X	
<i>Plocamium angustum</i>			X
<i>Plocamium cirrhosum</i>	X	X	
<i>Pterocladia lucida</i>	X	X	
<i>Pterocладиella capillacea</i>	X	X	
<i>Ptilonia mooreana</i>	X	X	X
<i>Sarcotalia lanceata</i>	X		
<i>Sargassum sinclairii</i>	X	X	X
<i>Scytothamnus australis</i>		X	X
<i>Ulva pertusa</i>	X		
<i>Vidalia colensoi</i>	X	X	
<i>Xiphophora chondrophylla</i>	X	X	X
<i>Zonaria sp.</i>	X	X	

Table S4. Species richness and Shannon index values (mean  $\pm$  standard error) by island/invasion history.

Invasion history (Island)	Species richness	Shannon index
Recently eradicated (Ahuahu/Great Mercury)	1.90 $\pm$ 0.10	0.39 $\pm$ 0.04
Eradicated 30+ years ago (Korapuki)	2.74 $\pm$ 0.11	0.69 $\pm$ 0.04
Never invaded (Atiu/Middle and Green)	3.75 $\pm$ 0.15	0.96 $\pm$ 0.04

Table S5. Top five candidate models for each macroalgae species ranked by Akaike information criterion (AIC<sub>c</sub>) and model weight ( $w_i$ ).

Model	K	Log		$\Delta$ AIC <sub>c</sub>	$w_i$
		Likelihood	AIC <sub>c</sub>		
<i>C. flexuosum</i> (19 models)					
Depth + Wave + Islands + Season + Depth:Islands + Islands:Season	10	-64.76	153.59	0.00	0.28
Depth + Wave + Islands + Season + Depth:Islands + Depth:Season + Islands:Season	11	-63.63	154.24	0.65	0.20
Depth + Wave + Islands + Season + Depth:Islands	9	-67.43	156.12	2.53	0.08
Depth + Wave + Islands + Runoff + Season + Depth:Islands + Islands:Season	11	-64.76	156.49	2.90	0.07
Depth + Wave + Islands + Runoff + Season + Depth:Islands + Depth:Season + Islands:Season	12	-63.49	156.99	3.39	0.05
<i>C. maschalocarpum</i> (20 models)					
Depth + Wave + Islands + Season	10	-52.31	129.52	0.00	0.21
Depth + Wave + Islands + Runoff + Season	11	-50.83	129.65	0.14	0.20
Depth + Wave + Islands + Season + Depth:Season	11	-51.47	130.94	1.43	0.10
Depth + Wave + Islands + Runoff + Season + Depth:Season	12	-50.03	131.31	1.80	0.09
Depth + Wave + Islands + Season + Depth:Islands	12	-50.70	132.66	3.14	0.04
<i>C. plumosum</i> (16 models)					
Depth + Wave + Islands + Season	12	-51.81	133.29	0.00	0.18
Depth + Wave + Islands + Season + Depth:Islands	13	-50.31	133.36	0.07	0.17
Depth + Wave + Islands + Runoff + Season + Depth:Islands	14	-48.97	133.86	0.57	0.14
Depth + Wave + Islands + Runoff + Season	13	-50.68	134.10	0.81	0.12
Depth + Wave + Islands + Season + Islands:Season	13	-51.63	136.00	2.71	0.05
<i>E. radiata</i> (21 models)					
Season	8	-81.94	181.94	0.00	0.21
Depth + Season + Depth:Season	10	-79.55	182.33	0.39	0.17
Runoff + Season	9	-81.79	184.19	2.25	0.07
Depth + Runoff + Season + Depth:Season	11	-79.2	184.34	2.40	0.06
Runoff + Season + Runoff:Season	10	-80.56	184.35	2.41	0.06
<i>V. colensoi</i> (14 models)					
Depth + Wave + Islands + Runoff + Season	8	-32.14	85.83	0.00	0.21
Wave + Islands + Runoff + Season	7	-33.93	86.02	0.19	0.19
Wave + Islands + Runoff + Season + Islands:Season	8	-32.88	87.30	1.48	0.10
Wave + Islands + Season + Islands:Season	7	-34.84	87.83	2.00	0.08
Wave + Islands + Season	6	-36.58	88.16	2.33	0.06
<i>X. chondrophylla</i> (8 models)					
Depth + Wave + Islands + Season + Depth:Islands + Depth:Season	18	-64.52	174.29	0.00	0.35
Depth + Wave + Islands + Runoff + Season + Depth:Islands + Depth:Season	19	-63.33	175.06	0.77	0.24
Depth + Wave + Islands + Season + Depth:Islands	17	-66.91	175.98	1.69	0.15
Depth + Islands + Season + Depth:Islands + Depth:Season	18	-65.99	177.22	2.93	0.08
Depth + Wave + Islands + Runoff + Season + Depth:Islands + Depth:Season + Runoff:Season	17	-67.54	177.24	2.94	0.08

Table S6. Parameter estimates, standard error (SE), lower confidence interval (LCI), and upper confidence interval (UCI) for each species ranked by relative importance.

Parameter	Model Averaged				Relative Importance
	Parameter Estimate	SE	LCI	UCI	
<i>C. flexuosum</i>					
Intercept	5.710	0.769	4.202	7.217	1.00
Season (Rainy)	1.384	0.583	0.241	2.527	1.00
Wave	-0.013	0.006	-0.024	-0.003	0.95
Islands (Eradicated 30 yrs)	0.937	0.800	-0.506	2.557	0.91
Depth	0.073	0.177	-0.281	0.445	0.89
Depth : Islands (Eradicated 30 yrs)	-0.329	0.252	-0.740	-0.097	0.79
Islands (Eradicated 30 yrs) : Season (Rainy)	0.621	0.525	-0.080	1.701	0.77
Depth : Season	-0.075	0.168	-0.672	0.212	0.33
Runoff	-0.001	0.004	-0.022	0.016	0.18
Runoff : Season (Rainy)	0.000	0.003	-0.044	0.037	0.01
<i>C. maschalocarpum</i>					
Intercept	6.342	0.878	4.622	8.062	1.00
Season (Rainy)	1.922	0.362	1.211	2.632	1.00
Depth	-0.081	0.221	-0.515	0.353	1.00
Islands (Eradicated 30 yrs)	-0.153	0.550	-1.231	0.924	1.00
Islands (Never invaded)	1.672	0.952	-0.193	3.538	
Wave	-0.020	0.010	-0.037	-0.009	0.89
Runoff	0.008	0.013	-0.007	0.047	0.42
Depth : Season (Rainy)	-0.052	0.097	-0.365	0.066	0.35
Depth : Islands (Eradicated 30 yrs)	-0.074	0.199	-0.894	0.296	0.25
Depth : Islands (Never invaded)	-0.233	0.478	-1.931	0.046	
Islands (Eradicated 30 yrs) : Season (Rainy)	0.109	0.306	-0.421	1.467	0.21
Islands (Never invaded) : Season (Rainy)	0.339	0.805	-0.349	3.602	
Runoff : Season (Rainy)	0.000	0.003	-0.023	0.031	0.06
<i>C. plumosum</i>					
Intercept	7.480	0.416	6.664	8.296	1.00
Season (Rainy)	2.121	0.282	1.569	2.674	1.00
Depth	-0.255	0.082	-0.416	-0.094	1.00
Wave	-0.015	0.003	-0.021	-0.009	0.99
Islands (Never invaded)	0.762	0.380	0.043	1.502	0.97
Depth : Islands (Middle & Green)	-0.080	0.104	-0.343	0.016	0.48
Runoff	-0.010	0.015	-0.052	0.009	0.47
Depth : Season (Rainy)	-0.010	0.046	-0.260	0.135	0.19
Islands (Never invaded) : Season (Rainy)	0.033	0.187	-0.634	1.061	0.18
Runoff : Season (Rainy)	-0.001	0.008	-0.066	0.027	0.10
<i>E. radiata</i>					
Intercept	5.827	0.670	4.514	7.141	1.00
Season (Rainy)	1.573	0.766	0.072	3.073	1.00
Depth	-0.102	0.150	-0.503	0.112	0.52
Depth : Season (Rainy)	-0.136	0.195	0.005	0.656	0.41
Runoff	-0.004	0.009	-0.034	0.012	0.35
Runoff : Season (Rainy)	0.004	0.010	-0.006	0.050	0.19
Wave	0.000	0.003	-0.012	0.013	0.16
Islands (Eradicated 30 yrs)	0.045	0.245	-0.764	1.875	0.08
Islands (Never invaded)	0.049	0.351	-1.528	2.724	

Depth : Islands (Eradicated 30 yrs)	-0.007	0.049	-0.542	0.040	0.03
Depth : Islands (Never invaded)	-0.013	0.086	-0.907	-0.021	
Islands (Eradicated 30 yrs) : Season (Rainy)	-0.019	0.138	-1.629	0.275	0.03
Islands (Never invaded) : Season (Rainy)	0.017	0.161	-0.842	2.091	
<i>V. colensoi</i>					
Intercept	6.698	0.637	5.450	7.946	1.00
Wave	-0.017	0.006	-0.028	-0.006	1.00
Islands (Never invaded)	1.700	0.527	0.672	2.736	1.00
Season (Rainy)	1.004	0.409	0.203	1.805	1.00
Runoff	0.031	0.028	-0.006	0.090	0.75
Depth	-0.103	0.180	-0.617	0.203	0.50
Islands (Never invaded) : Season (Rainy)	-0.160	0.375	-1.614	0.393	0.26
Runoff : Season (Rainy)	-0.004	0.031	-0.196	0.136	0.12
Depth : Islands (Never invaded)	-0.023	0.123	-0.953	0.348	0.08
Depth : Season (Rainy)	-0.008	0.151	-1.612	1.241	0.04
<i>X. chondrophylla</i>					
Intercept	6.571	0.409	5.769	7.374	1.00
Depth	0.106	0.109	-0.107	0.319	1.00
Islands (Eradicated 30 yrs)	-0.285	0.231	-0.738	0.168	1.00
Islands (Never invaded)	1.539	0.322	0.909	2.169	
Season (Rainy)	0.997	0.311	0.388	1.607	1.00
Depth : Islands (Eradicated 30 yrs)	-0.056	0.062	-0.177	0.065	1.00
Depth : Islands (Never invaded)	-0.459	0.084	-0.624	-0.294	
Wave	-0.007	0.004	-0.015	-0.001	0.89
Depth : Season (Rainy)	0.134	0.109	0.006	0.352	0.75
Runoff	0.004	0.007	-0.007	0.024	0.42
Runoff : Season (Rainy)	0.000	0.004	-0.031	0.018	0.07

Table S7. Water ammonia and nitrate concentrations (mean ± standard error) during the dry and rainy seasons by island/invasion history.

Invasion history (Island)	Ammonia (mg/l)		Nitrate (mg/l)	
	Dry	Rainy	Dry	Rainy
Never invaded (Atiu/Middle and Green)	0.036 ± 0.014	0.052 ± 0.011	0.998 ± 0.103	5.842 ± 0.443
Eradicated 30+ years ago (Korapuki)	0.105 ± 0.032	0.049 ± 0.009	2.545 ± 0.608	5.116 ± 0.710
Recently eradicated (Ahuahu/Great Mercury)	0.056 ± 0.019	0.077 ± 0.011	0.686 ± 0.063	6.700 ± 0.523

Table S8. Mean collection depths (± standard error) for *Carpophyllum maschalocarpum* and *Xiphophora chondrophylla* on the previously eradicated (Korapuki) and recently eradicated (Ahuahu/Great Mercury) islands.

Invasion history (Island)	Collection depth (m)	
	<i>Carpophyllum maschalocarpum</i>	<i>Xiphophora chondrophylla</i>
Eradicated 30+ years ago (Korapuki)	2.95 ± 0.27	2.21 ± 0.18
Recently eradicated (Ahuahu/Great Mercury)	1.25 ± 0.11	1.62 ± 0.34

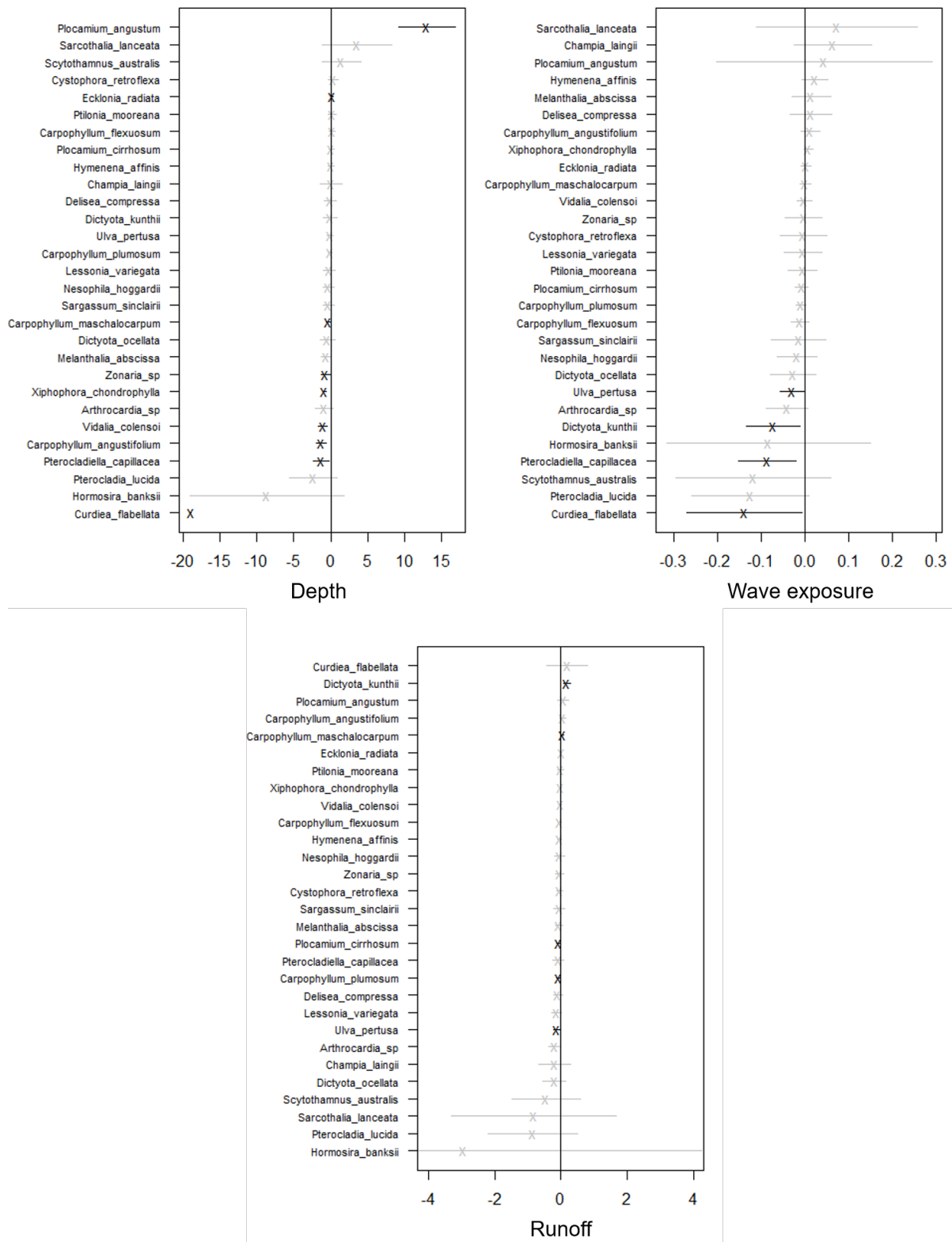


Figure S1. Estimated coefficients of environmental variables and their 95% confidence intervals for each species. Grey lines denote intervals containing zero and black lines denote intervals not containing zero.

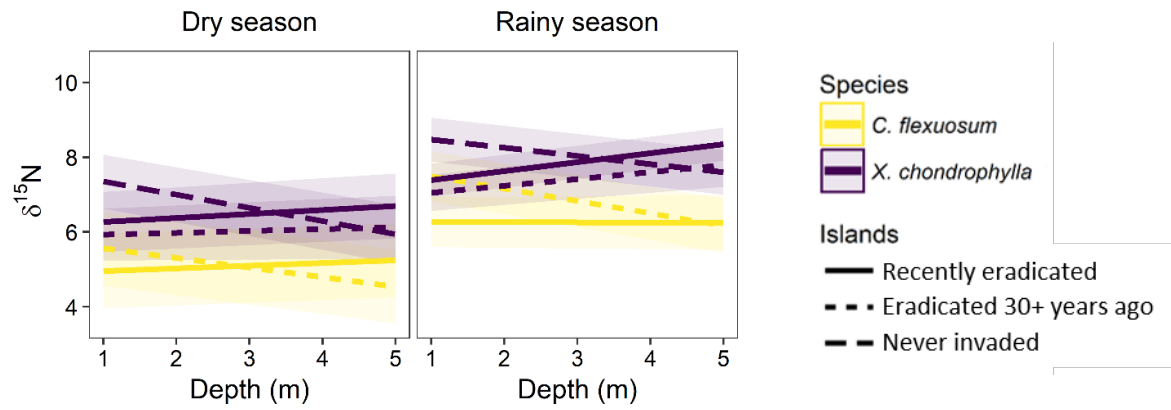


Figure S2. Linear mixed model averaged predictions of  $\delta^{15}\text{N}$  by depth and season. Colors denote species, line types are invasion histories, and ribbons define 95% confidence intervals.