

Appendix A: Supplementary tables and figures

TABLE A1. Functional traits measured for each species included in the experiment, along with their units and functional interpretation for ecosystem functioning.

Trait	Units	Functional Interpretation
Defense	Categorical: None, shell (chitin, calcium carbonate)	Palatability and likelihood of consumption and trophic transfer
Body plan	Categorical: Articulate (laterally-, ventrally-compressed, subcylindrical), shelled conic, filiform, fusiform	Habitat use and palatability
Trophic level	Categorical: Grazer, omnivore, predator	Resource use and trophic transfer
Maximum biomass	Continuous (mg)	Maximum contribution to community production
Mean biomass	Continuous (mg)	Average contribution to community production
Mobility	Categorical: Swimmer (low, high), tube-builder, crawler	Dispersal ability and potential for interactions (competition, predation, etc.)
Reproductive mode	Categorical: Direct, planktotrophic, ovoviviparous, oviparous	Dispersal ability, colonization potential, and population growth
Month of maximum abundance	Ordered (Jan, Feb, Mar, etc.)	Historical interactions with competitors and predators, resource use

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TABLE A2. Standardized regression coefficients (scaled by mean and variance) from generalized linear mixed effects models regression ecosystem responses against species richness (S), functional diversity (FD), and their interaction (S x FD). Significant predictors ($P < 0.05$) are denoted in bold. Marginal R^2_m and conditional R^2_c values are also reported.

Response	S	FD	S x FD	R^2_m	R^2_c
Final grazer biomass	0.292	-0.410	-0.012	0.28	0.28
Final predator biomass	-0.145	0.469	0.088	0.68	0.68
Recruiting invertebrate biomass	0.014	-0.118	0.016	0.31	0.45
Final algal biomass	-0.022	-0.002	0.013	0.03	0.03
Final <i>Gracilaria</i> biomass	0.548	-0.211	0.161	0.16	0.16
Final species richness	2.226	-0.602	-0.382	0.63	0.63
Final functional diversity	-0.015	0.291	-0.021	0.75	0.75

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TABLE A3. The change in model likelihood (ΔAIC) after dropping a single trait and recalculating multivariate functional richness using the remaining seven traits ($\Delta AIC = AIC_{All\ traits} - AIC_{1\ trait\ removed}$). The trait removed is indicated in the column header: armor, body plan, trophic level, maximum biomass, mean biomass, reproductive mode, and month of maximum abundance. Bolded cells indicate models that were more than ± 2 units difference in AIC scores. An increase in ΔAIC indicates a decrease in model likelihood (i.e., the model was less likely than the full model), and thus the trait had a stronger influence in predicting the response. Oppositely, a decrease in ΔAIC indicates an increase in model likelihood (i.e., the model was more likely than the full model), and thus the trait had a weaker or confounding influence in predicting the response.

Response	Armor	Body plan	Trophic level	Max. biomass	Mean biomass	Mobility	Reprod. mode	Month max. abund
Final grazer biomass	0.79	-0.51	-0.19	-0.01	-0.03	0.34	0.51	1.72
Final predator biomass	-0.86	2.67	2.19	1.05	1.92	-4.29	3.72	-4.67
Recruit invert biomass	-0.91	0.36	1.54	0.30	-0.09	0.63	1.22	1.47
Final algal biomass	-0.14	0.02	0.02	0.01	0.01	-0.04	0	-0.26
Final <i>Gracilaria</i> biomass	-0.87	0.77	0.49	0.29	0.12	0.22	0.09	-0.73

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TABLE A4. Linear coefficients from the structural equation model decomposing independent predator and herbivore functional diversity effects given in Figure 3, main text.

Response	Predictor	Estimate	Standard Error	P-value
Final algal biomass	Final grazer biomass	-0.168	0.106	0.116
Final algal biomass	Final predator biomass	0.333	0.106	0.002
Final grazer biomass	Final grazer functional richness	0.142	0.050	0.006
Final grazer biomass	Final predator biomass	-0.006	0.023	0.794
Final grazer biomass	Final predator functional richness	0.008	0.012	0.508
Final grazer biomass	Initial grazer abundance	0.005	0.082	0.956
Final grazer biomass	Initial grazer functional richness	-0.267	0.138	0.057
Final grazer biomass	Initial predator biomass	-0.180	0.080	0.028
Final grazer biomass	Initial predator functional richness	0.224	0.151	0.144
Final grazer functional richness	Final predator biomass	-0.335	0.137	0.017
Final grazer functional richness	Initial grazer functional richness	0.476	0.137	0.001
Final predator biomass	Final predator functional richness	-0.083	0.086	0.338
Final predator biomass	Initial grazer functional richness	0.327	0.118	0.007
Final predator biomass	Initial predator biomass	0.002	0.089	0.984
Final predator biomass	Initial predator functional richness	0.464	0.121	0.000
Final predator functional richness	Initial predator functional richness	0.333	0.106	0.002
Final recruiting invertebrate biomass	Final grazer biomass	0.292	0.095	0.003
Final recruiting invertebrate biomass	Final grazer functional richness	0.098	0.094	0.303
Final recruiting invertebrate biomass	Final predator biomass	-0.370	0.098	0.000
Final recruiting invertebrate biomass	Final predator functional richness	-0.019	0.096	0.846
Initial grazer functional richness	Initial predator functional richness	r = 0.715		0.000

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TABLE A5. Linear coefficients from the structural equation model decomposing independent predator and herbivore species richness effects given in Figure 4, main text.

Response	Predictor	Estimate	Standard Error	P-value
Final algal biomass	Final grazer biomass	-0.168	0.106	0.116
Final algal biomass	Final predator biomass	0.333	0.106	0.002
Final grazer biomass	Final grazer richness	0.059	0.079	0.457
Final grazer biomass	Final predator biomass	0.005	0.015	0.756
Final grazer biomass	Final predator richness	-0.003	0.039	0.932
Final grazer biomass	Initial grazer abundance	-0.028	0.111	0.803
Final grazer biomass	Initial grazer richness	0.145	0.149	0.335
Final grazer biomass	Initial predator biomass	-0.037	0.053	0.493
Final grazer biomass	Initial predator richness	-0.303	0.143	0.037
Final grazer richness	Final predator biomass	-0.389	0.107	0.001
Final grazer richness	Initial grazer richness	0.810	0.106	0.000
Final predator biomass	Final predator richness	0.217	0.146	0.141
Final predator biomass	Initial grazer richness	0.154	0.096	0.115
Final predator biomass	Initial predator biomass	-0.004	0.081	0.964
Final predator biomass	Initial predator richness	0.457	0.165	0.007
Final predator richness	Initial predator richness	0.868	0.055	0.000
Final recruiting invertebrate biomass	Final grazer biomass	0.263	0.098	0.009
Final recruiting invertebrate biomass	Final grazer richness	0.120	0.098	0.228
Final recruiting invertebrate biomass	Final predator biomass	-0.275	0.135	0.045
Final recruiting invertebrate biomass	Final predator richness	-0.163	0.137	0.237
Initial grazer richness	Initial predator richness	0.666		0.000

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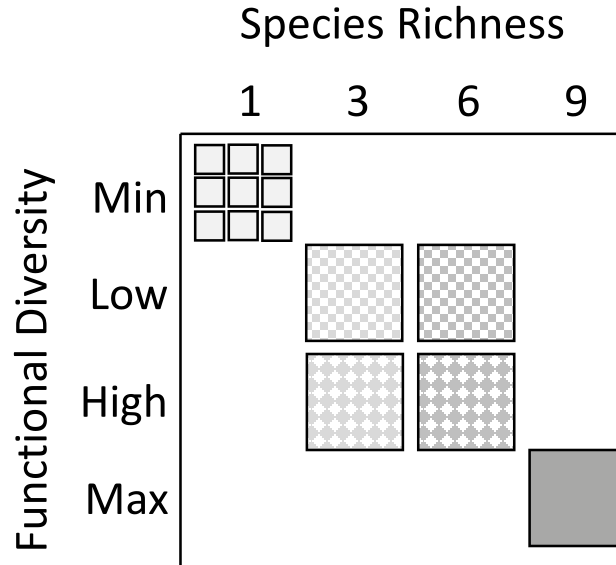


FIG. A1. A schematic of the experimental design. We utilized four levels of species richness: 1, 3, 6, and 9. Each of the 9 species was represented in the single-species treatments (the 9 individual squares). All species were present in the 9-species mixture. For the 3- and 6-species treatments, we generated all possible combinations of species and calculated functional diversity (FD, as functional richness). We then randomly drew replicate assemblages from the lower 25th percentile to represent ‘low FD,’ and repeated this exercise for the upper 75th percentile to represent ‘high FD.’ The single species represented the minimum level of FD (FD = 0). The 9-species mixture represented the highest level of FD (maximum FD, visually depicted in reduced trait space in Figure A2).

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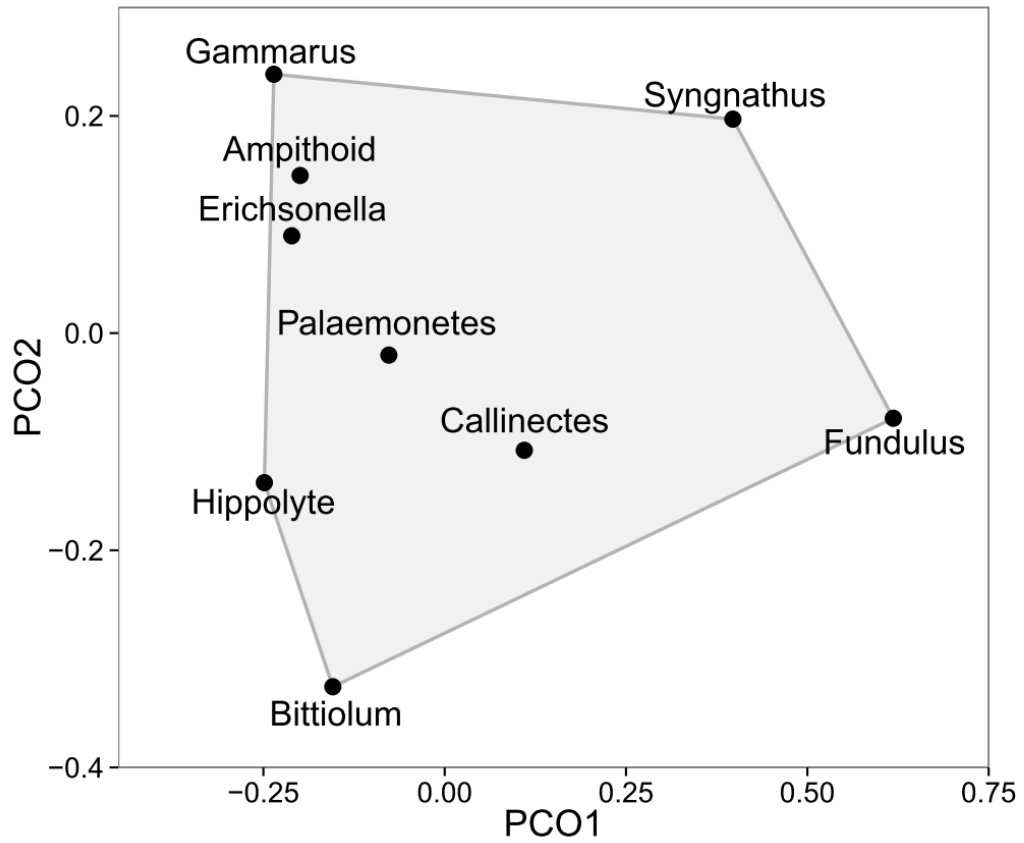


FIG. A2. Principal coordinates analysis (PCO) collapsing 8 functional traits into 2-dimensions. The convex hull for the polyculture—the area of trait space encompassed by all 9 species—is indicated in the shaded polygon.

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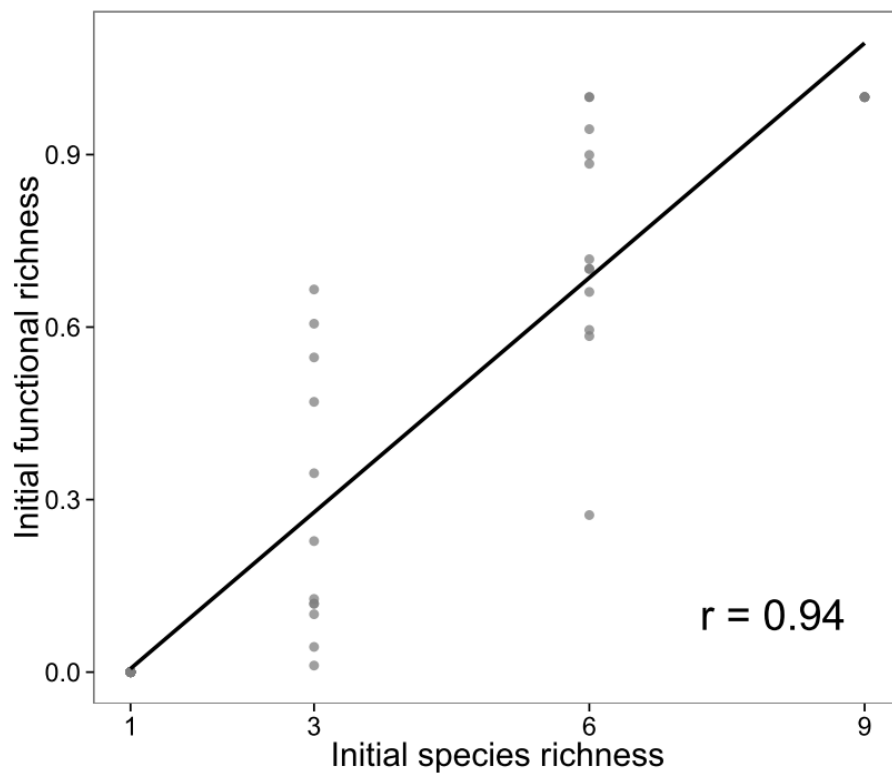


FIG. A3. Plot of initial species richness against initial functional richness (Pearson's correlation $r = 0.94$).

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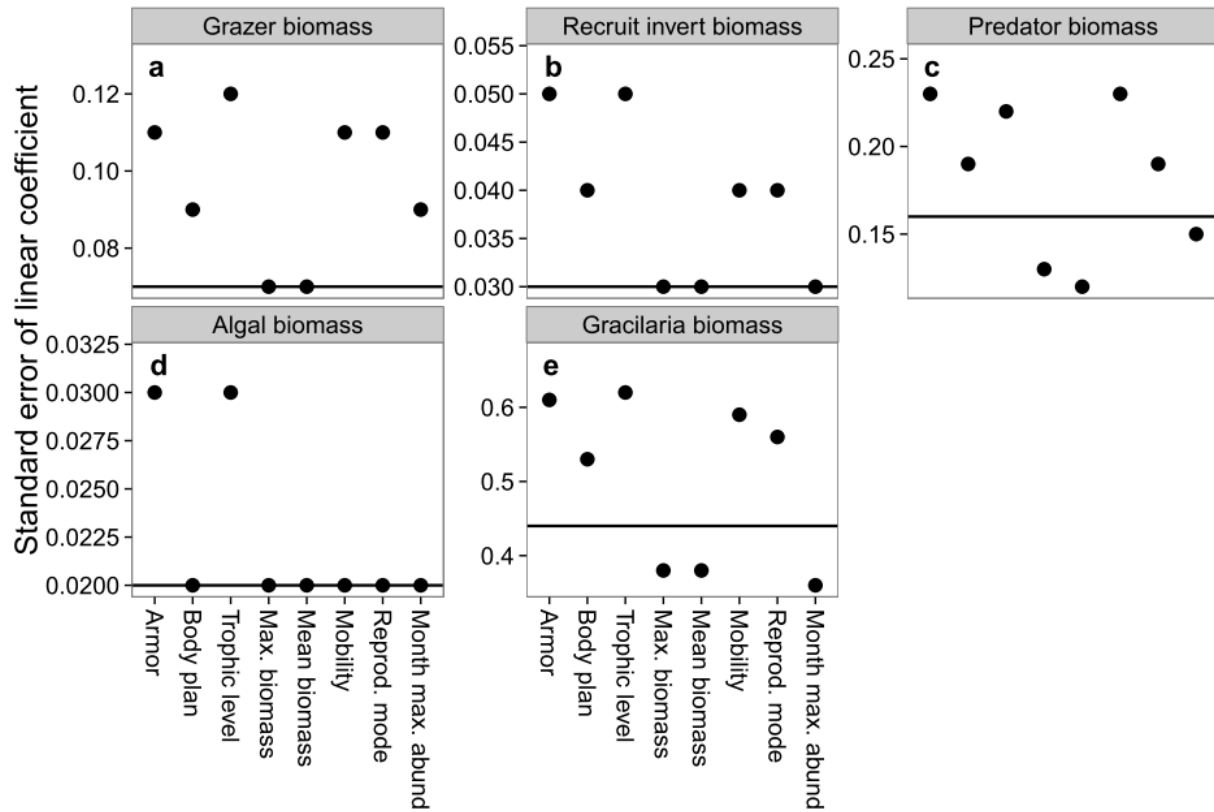


FIG. A4. Standard errors of linear coefficients extracted from general linear mixed effects models regressing ecosystem responses against univariate and multivariate functional richness. Traits used in the univariate calculation of FD are listed on the x-axis, and the standard error of the multivariate FD estimate is given as the horizontal line. If points fall above this line, then variance around the univariate estimates was greater than around the multivariate one.

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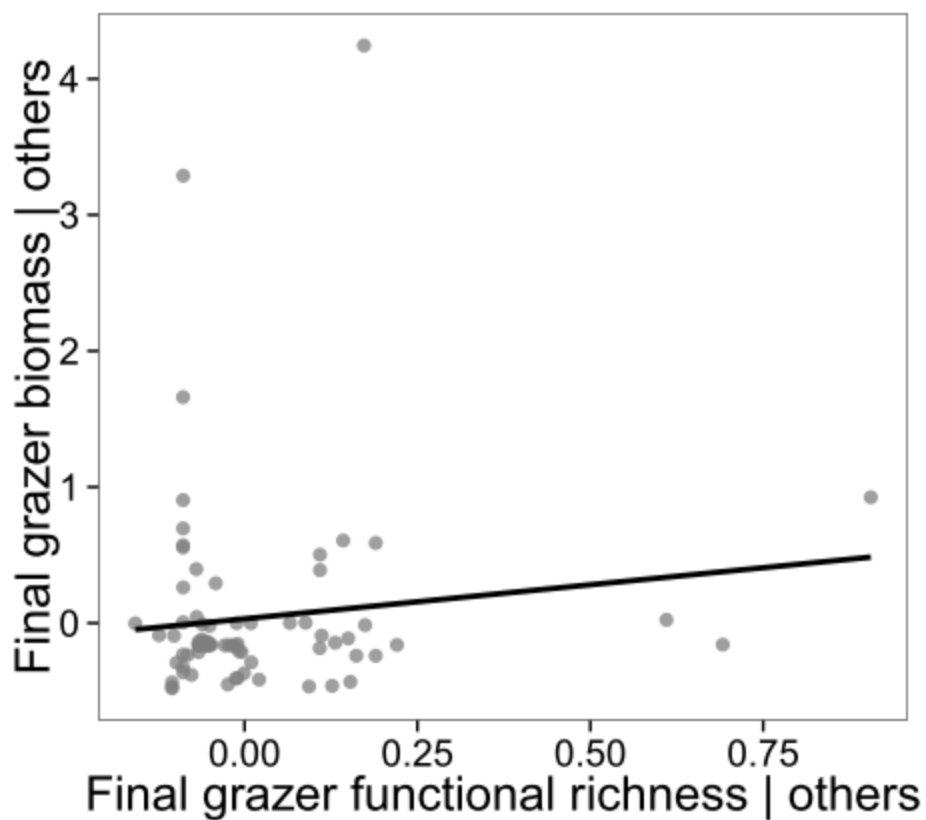


FIG. A5. Partial residuals plot of final grazer functional richness against final grazer biomass (mg AFDM), after accounting for additional covariates.

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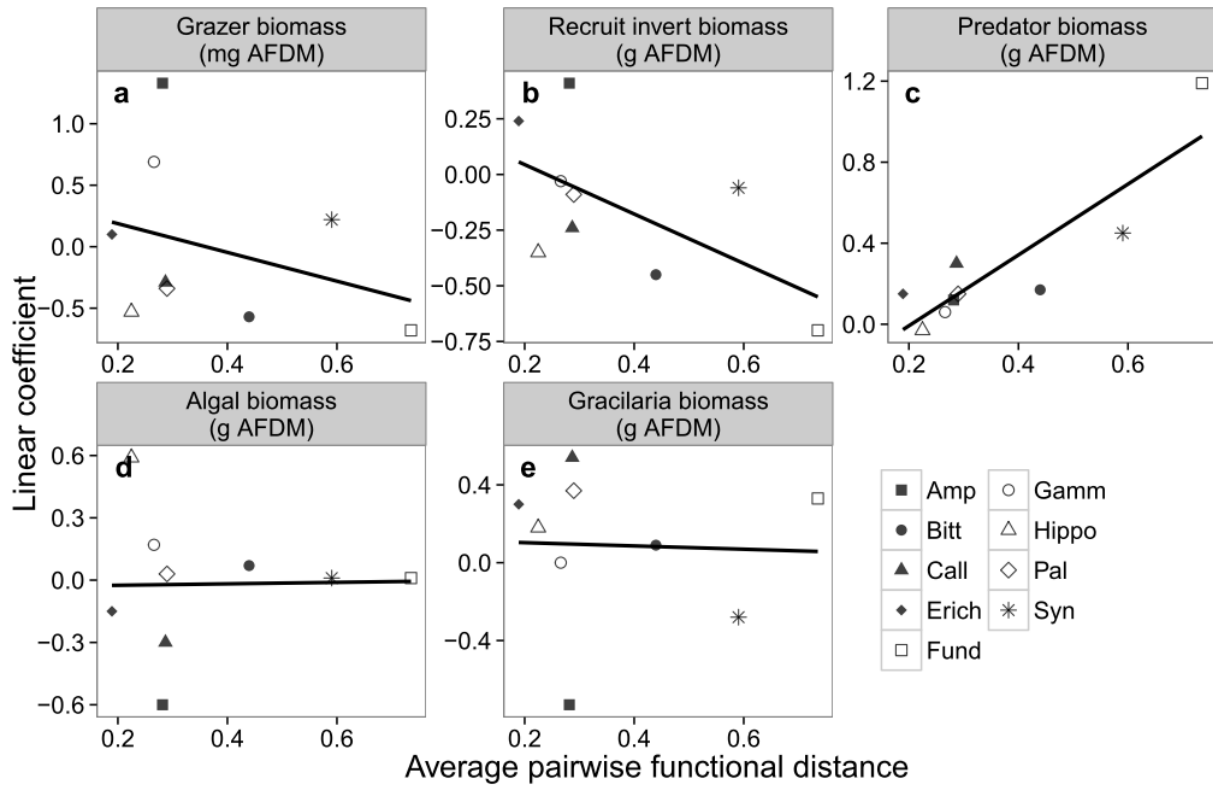


FIG. A6. Average pairwise functional distance (based on Gower dissimilarity) plotted against effect sizes for each of the 9 species derived from a general linear mixed effects model regressing the presence/absence of each species against each ecosystem response. Black lines represent predicted trends from a simple linear regression.

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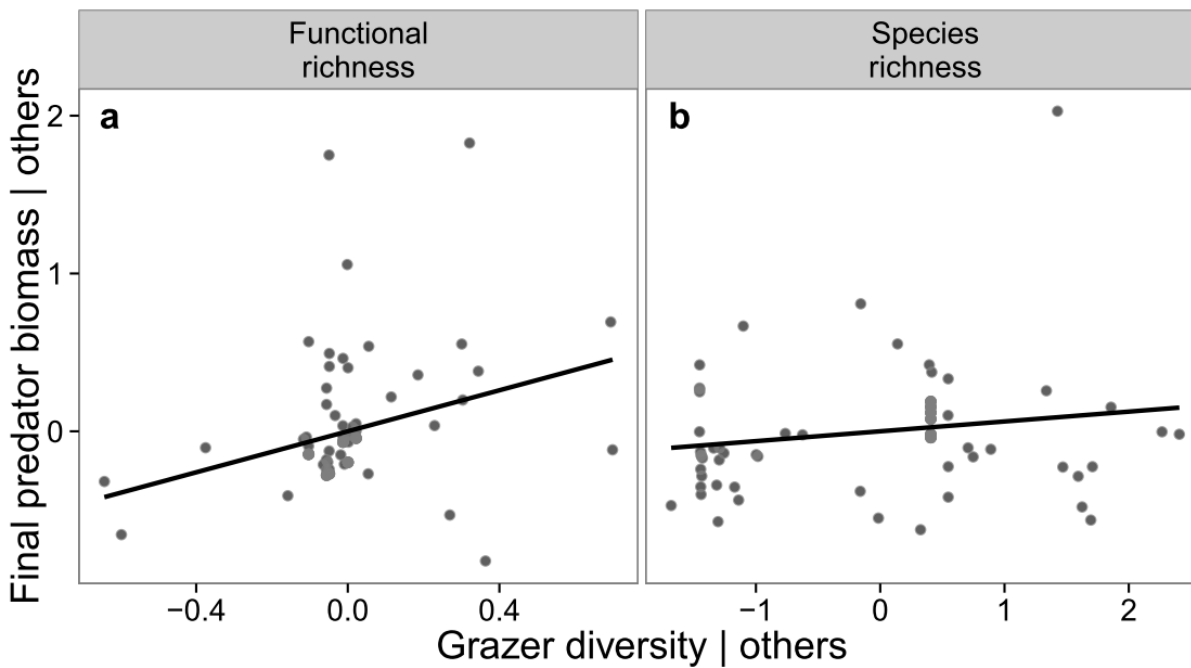


FIG. A7. Partial effects plots of (a) initial grazer functional richness and (b) initial grazer species richness on final predator biomass, accounting for covariates (initial predator diversity, initial predator biomass, and final predator diversity).

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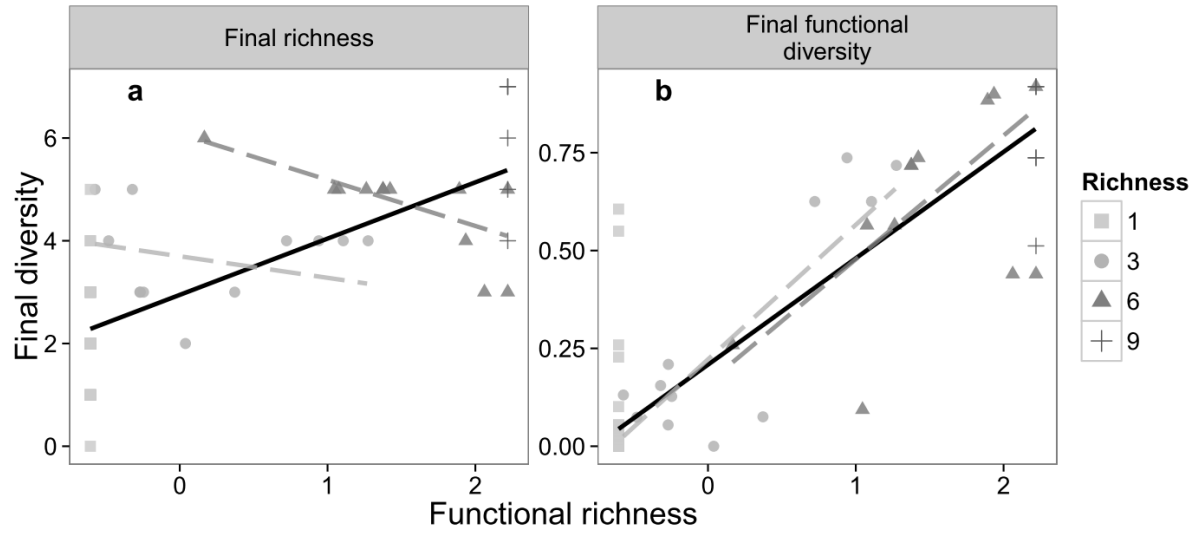


FIG. A8. Scatterplot of initial FD (scaled by mean and variance) against **(a)** final species richness and **(b)** final FD of all stocked species. Shapes corresponds to the richness level (1, 3, 6, or 9). Grey lines represent predicted fits from a general linear mixed effects model for 3- (light grey) and 6-species (dark grey) treatments (Table A2). The black line represents the overall trend from the same model.