

## Appendix S1

Tree divergences	Trait evolution variance	Coevolutionary community	Interaction weights	Mean	Standard deviation
Shallow	Low	No coevolution, no cospeciation	Unweighted	5.313	3.342
Shallow	Low	Coevolution, no cospeciation	Unweighted	6.05	3.163
Shallow	Low	No coevolution, cospeciation	Unweighted	6.053	3.169
Shallow	Low	Coevolution, cospeciation	Unweighted	7.54	2.311
Deep	Low	No coevolution, no cospeciation	Unweighted	6.327	2.926
Deep	Low	Coevolution, no cospeciation	Unweighted	6.015	3.167
Deep	Low	No coevolution, cospeciation	Unweighted	6.04	3.223
Deep	Low	Coevolution, cospeciation	Unweighted	7.489	2.34
Deep	High	No coevolution, no cospeciation	Unweighted	1.866	4.271
Deep	High	Coevolution, no cospeciation	Unweighted	6.112	3.142
Deep	High	No coevolution, cospeciation	Unweighted	6.129	3.123
Deep	High	Coevolution, cospeciation	Unweighted	7.56	2.288
Shallow	High	No coevolution, no cospeciation	Unweighted	5.27	3.354
Shallow	High	Coevolution, no cospeciation	Unweighted	6.002	3.188
Shallow	High	No coevolution, cospeciation	Unweighted	6.055	3.204
Shallow	High	Coevolution, cospeciation	Unweighted	7.496	2.343
Shallow	Low	No coevolution, no cospeciation	Weighted	0.932	4.239
Shallow	Low	Coevolution, no cospeciation	Weighted	3.101	3.927
Shallow	Low	No coevolution, cospeciation	Weighted	3.116	3.917
Shallow	Low	Coevolution, cospeciation	Weighted	2.709	4.985
Deep	Low	No coevolution, no cospeciation	Weighted	3.306	3.851
Deep	Low	Coevolution, no cospeciation	Weighted	3.153	3.887
Deep	Low	No coevolution, cospeciation	Weighted	3.276	3.883
Deep	Low	Coevolution, cospeciation	Weighted	2.696	5.051
Deep	High	No coevolution, no cospeciation	Weighted	-0.525	3.697
Deep	High	Coevolution, no cospeciation	Weighted	3.145	3.851
Deep	High	No coevolution, cospeciation	Weighted	3.183	3.849
Deep	High	Coevolution, cospeciation	Weighted	2.772	4.929
Shallow	High	No coevolution, no cospeciation	Weighted	0.807	4.246
Shallow	High	Coevolution, no cospeciation	Weighted	2.992	3.908
Shallow	High	No coevolution, cospeciation	Weighted	3.083	3.887
Shallow	High	Coevolution, cospeciation	Weighted	2.655	5.015

Table S1: The mean and standard deviation of the relative modularity (z-scores) of different coevolutionary communities (see Fig. 2 for parameter details).

Tree divergences	Trait evolution variance	Coevolutionary community	Interaction weights	Mean	Standard deviation
Shallow	Low	No coevolution, no cospeciation	Unweighted	-4.499	3.798
Shallow	Low	Coevolution, no cospeciation	Unweighted	-2.701	5.251
Shallow	Low	No coevolution, cospeciation	Unweighted	-2.738	5.218
Shallow	Low	Coevolution, cospeciation	Unweighted	-6.274	2.671
Deep	Low	No coevolution, no cospeciation	Unweighted	-3.165	4.877
Deep	Low	Coevolution, no cospeciation	Unweighted	-2.699	5.254
Deep	Low	No coevolution, cospeciation	Unweighted	-2.823	5.169
Deep	Low	Coevolution, cospeciation	Unweighted	-6.257	2.68
Deep	High	No coevolution, no cospeciation	Unweighted	0.84	6.298
Deep	High	Coevolution, no cospeciation	Unweighted	-2.66	5.275
Deep	High	No coevolution, cospeciation	Unweighted	-2.795	5.191
Deep	High	Coevolution, cospeciation	Unweighted	-6.242	2.694
Shallow	High	No coevolution, no cospeciation	Unweighted	-4.706	3.739
Shallow	High	Coevolution, no cospeciation	Unweighted	-2.699	5.257
Shallow	High	No coevolution, cospeciation	Unweighted	-2.722	5.278
Shallow	High	Coevolution, cospeciation	Unweighted	-6.255	2.695
Shallow	Low	No coevolution, no cospeciation	Weighted	-1.964	5.106
Shallow	Low	Coevolution, no cospeciation	Weighted	-0.712	5.688
Shallow	Low	No coevolution, cospeciation	Weighted	-0.76	5.674
Shallow	Low	Coevolution, cospeciation	Weighted	-4.371	3.759
Deep	Low	No coevolution, no cospeciation	Weighted	-1.14	5.42
Deep	Low	Coevolution, no cospeciation	Weighted	-0.717	5.703
Deep	Low	No coevolution, cospeciation	Weighted	-0.873	5.6
Deep	Low	Coevolution, cospeciation	Weighted	-4.288	3.778
Deep	High	No coevolution, no cospeciation	Weighted	3.725	6.258
Deep	High	Coevolution, no cospeciation	Weighted	-0.715	5.704
Deep	High	No coevolution, cospeciation	Weighted	-0.885	5.603
Deep	High	Coevolution, cospeciation	Weighted	-4.348	3.753
Shallow	High	No coevolution, no cospeciation	Weighted	-2.16	5.061
Shallow	High	Coevolution, no cospeciation	Weighted	-0.713	5.679
Shallow	High	No coevolution, cospeciation	Weighted	-0.82	5.675
Shallow	High	Coevolution, cospeciation	Weighted	-4.374	3.765

Table S2: The mean and standard deviation of the relative nestedness (z-scores) of different coevolutionary communities (see Fig. 2 for parameter details).

Tree divergences	Trait evolution variance	Coevolutionary community	Interaction weights	Mean	Standard deviation
Shallow	Low	No coevolution, no cospeciation	Unweighted	0.004	0.075
Shallow	Low	Coevolution, no cospeciation	Unweighted	0.025	0.096
Shallow	Low	No coevolution, cospeciation	Unweighted	0.211	0.22
Shallow	Low	Coevolution, cospeciation	Unweighted	0.215	0.213
Deep	Low	No coevolution, no cospeciation	Unweighted	0.022	0.089
Deep	Low	Coevolution, no cospeciation	Unweighted	0.024	0.097
Deep	Low	No coevolution, cospeciation	Unweighted	0.205	0.214
Deep	Low	Coevolution, cospeciation	Unweighted	0.21	0.214
Deep	High	No coevolution, no cospeciation	Unweighted	0.038	0.142
Deep	High	Coevolution, no cospeciation	Unweighted	0.026	0.101
Deep	High	No coevolution, cospeciation	Unweighted	0.202	0.212
Deep	High	Coevolution, cospeciation	Unweighted	0.21	0.21
Shallow	High	No coevolution, no cospeciation	Unweighted	0.005	0.076
Shallow	High	Coevolution, no cospeciation	Unweighted	0.024	0.097
Shallow	High	No coevolution, cospeciation	Unweighted	0.213	0.217
Shallow	High	Coevolution, cospeciation	Unweighted	0.216	0.215
Shallow	Low	No coevolution, no cospeciation	Weighted	0.004	0.072
Shallow	Low	Coevolution, no cospeciation	Weighted	0.027	0.101
Shallow	Low	No coevolution, cospeciation	Weighted	0.21	0.219
Shallow	Low	Coevolution, cospeciation	Weighted	0.223	0.211
Deep	Low	No coevolution, no cospeciation	Weighted	0.023	0.092
Deep	Low	Coevolution, no cospeciation	Weighted	0.026	0.101
Deep	Low	No coevolution, cospeciation	Weighted	0.205	0.213
Deep	Low	Coevolution, cospeciation	Weighted	0.219	0.213
Deep	High	No coevolution, no cospeciation	Weighted	0.034	0.142
Deep	High	Coevolution, no cospeciation	Weighted	0.028	0.103
Deep	High	No coevolution, cospeciation	Weighted	0.201	0.214
Deep	High	Coevolution, cospeciation	Weighted	0.219	0.21
Shallow	High	No coevolution, no cospeciation	Weighted	0.005	0.071
Shallow	High	Coevolution, no cospeciation	Weighted	0.026	0.102
Shallow	High	No coevolution, cospeciation	Weighted	0.211	0.217
Shallow	High	Coevolution, cospeciation	Weighted	0.223	0.213

Table S3: The mean and standard deviation of the phylogenetic interaction signal of different coevolutionary communities (see Fig. 2 for parameter details).

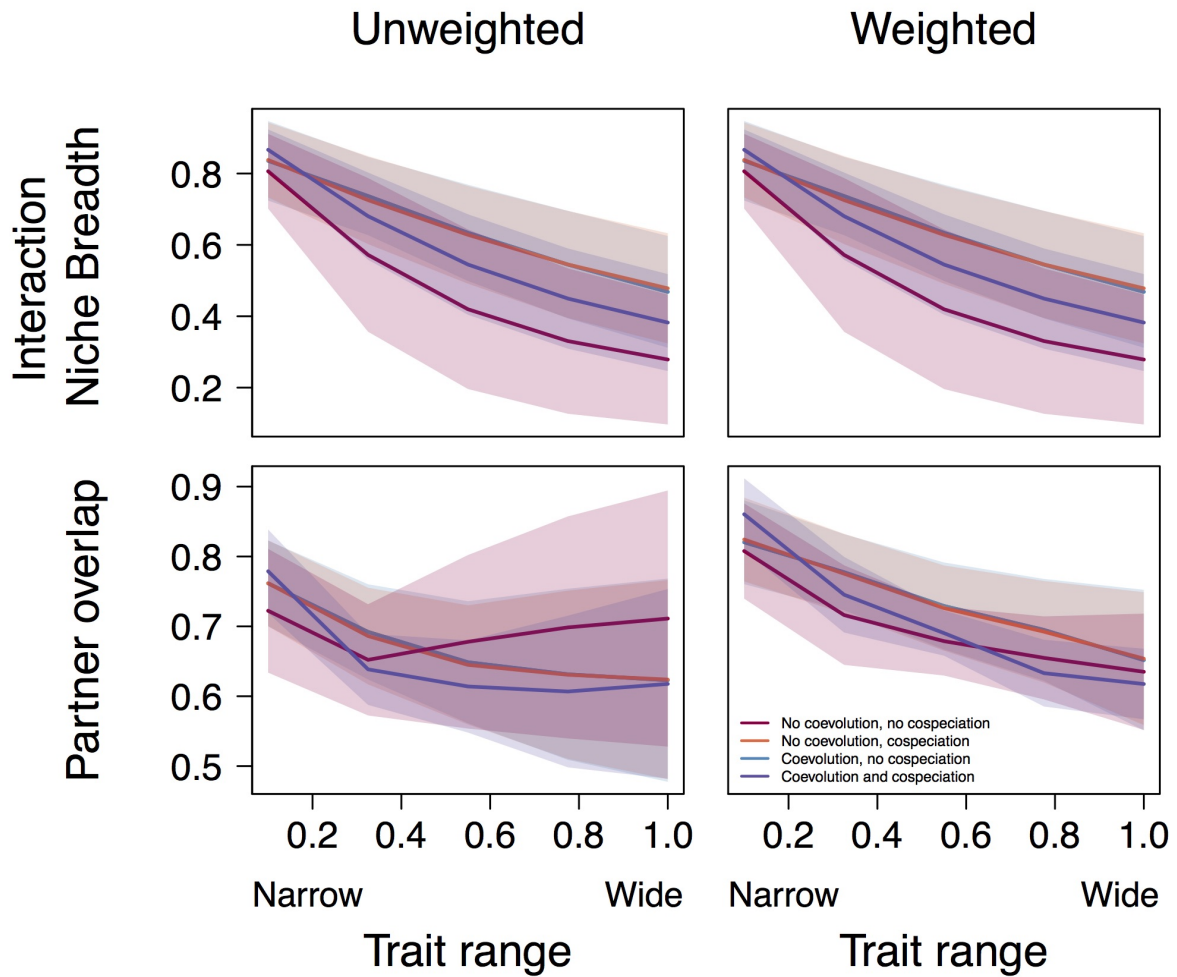


Figure S1: The effect of varying the trait range as a proportion of species' trait values from wide (1\*trait value) to narrow (0.1\*trait value) on interaction average niche breadth and partner overlap networks. Colored areas denote one standard deviation.

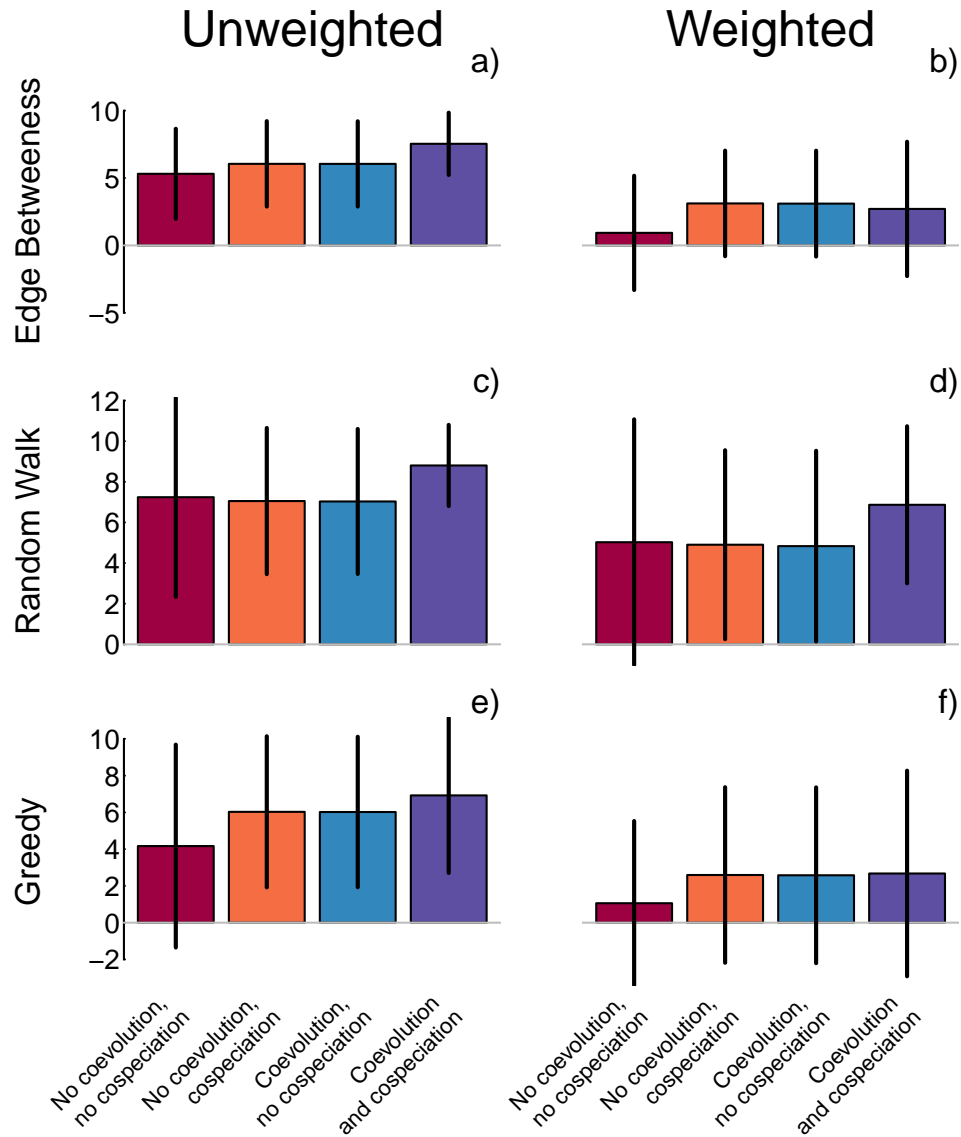


Figure S2: Edge Betweenness (a-b), Random Walk (c-d) and Greedy (e-f). The modularity of different coevolution communities calculated with different community partitioning methods. Communities evolved with a low trait evolution variance and shallow divergences between species of the same interaction group is represented as an example. Vertical bars denote one standard deviation.