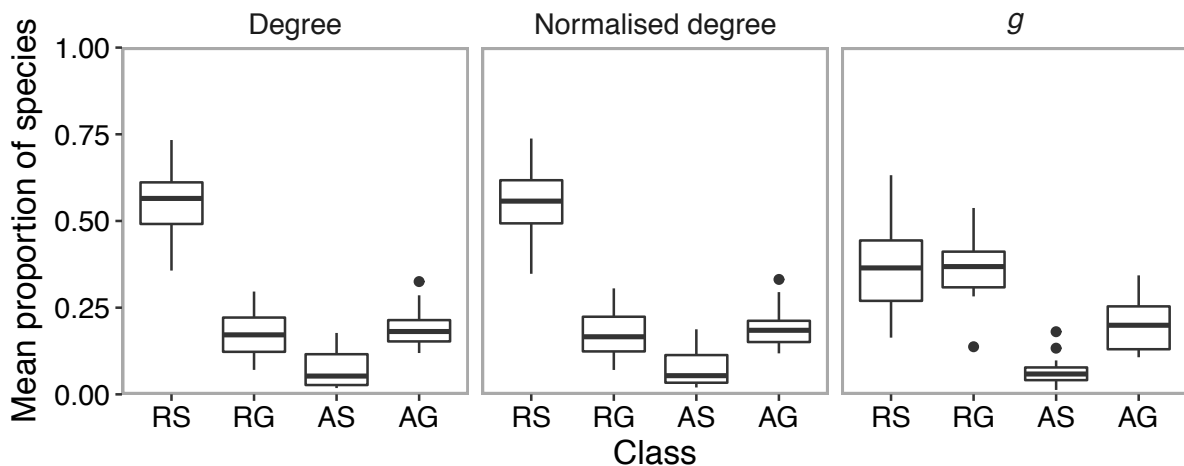


## Appendix 2

We repeated all analyses excluding four networks where we used frequency of occurrence (the proportion of days of fieldwork in which a given species was recorded) as a proxy for relative abundances, because species were not recorded within the sampling plots during transect counts or mist netting for these networks. We note that frequency of occurrence and relative abundance are strongly correlated and frequency of occurrence is still independent from the network data (Vizentin-Bugoni et al. 2014).

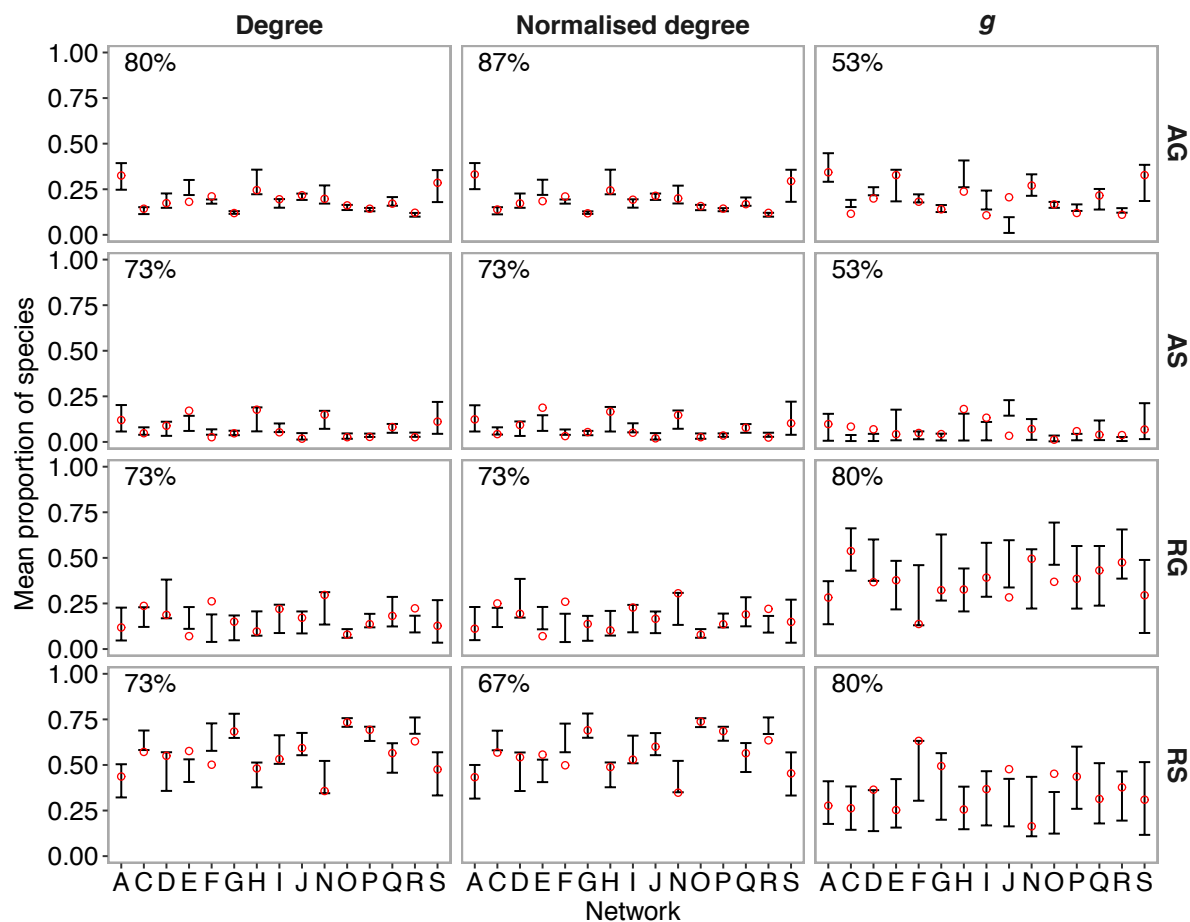
Results were qualitatively the same and conclusions identical after the exclusion of these networks. We confirmed the positive relationship between abundance and generalisation in our dataset, finding a significant correlation between abundance and generalisation for degree (Wald test:  $\chi^2 = 132.1$ ;  $df = 1$ ;  $P = < 0.001$ ;  $R^2_{GLMM(m)} = 0.52$ ;  $R^2_{GLMM(c)} = 0.81$ ), normalised degree (Wald test:  $\chi^2 = 129.41$ ;  $df = 1$ ;  $P = < 0.001$ ;  $R^2_{GLMM(m)} = 0.23$ ;  $R^2_{GLMM(c)} = 0.36$ ) and the generalisation index  $g$  (Wald test:  $\chi^2 = 14.94$ ;  $df = 1$ ;  $P = < 0.001$ ;  $R^2_{LMM(m)} = 0.10$ ;  $R^2_{LMM(c)} = 0.50$ ).

Only a small proportion of species were abundant and specialist for all three generalisation metrics (Fig. A1). Conversely, the proportion of species that were rare and generalist was consistently larger, particularly for the  $g$  generalisation metric. These differences were significant: the proportion of species that were rare and generalist was significantly higher than the proportion which were abundant and specialist for degree ( $t = 3.61$ ,  $df = 14$ ,  $p = 0.003$ ), normalised degree ( $t = 3.7$ ,  $df = 14$ ,  $p = 0.003$ ) and  $g$  ( $t = 10.6$ ,  $df = 14$ ,  $p = < 0.001$ ) (Fig. A1). Overall, these findings support hypothesis 1, that abundance drives generalisation, and do not support hypothesis 2, that generalisation drives abundance.



**Figure A1:** The mean proportion of hummingbird species classified as rare specialists ('RS'), rare generalists ('RG'), abundant specialists ('AS') and abundant generalists ('AG') across a subset of networks, for three generalisation metrics: degree, normalised degree and  $g$ . The subset excluded four networks where we used frequency of occurrence (the proportion of days of fieldwork in which a given species was recorded) as a proxy for relative abundances. The bold centre line in each box is the median; the lower and upper hinges are the first and third quartiles, respectively. The lower whisker indicates the smallest value no less than 1.5 times the inter-quartile range; the upper whisker indicates the largest value no greater than 1.5 times the inter-quartile range. Data outside the whiskers are outlying points plotted as solid black circles.

The proportion of species in each of the four abundance-generalisation categories predicted by the neutrality null model closely matched the empirical proportions, particularly for degree and normalised degree where there were no significant differences between observed and predicted proportions for the majority of networks (67–87% of networks; Fig. A2). For  $g$ , the model correctly predicted the proportion of rare specialists and generalists for 80% of networks, but performed less well in predicting the proportion of abundant specialists and generalists, with predictions matching observed values for only 53% of networks (Fig. A2).



**Figure A2:** Comparisons between empirical networks and null model networks in the proportions of species in each of the abundance-generalisation categories ‘RS’ (rare specialists), ‘RG’ (rare generalists), ‘AS’ (abundant specialists) and ‘AG’ (abundant generalists). Four networks (B, K, L, M) where we used frequency of occurrence (the proportion of days of fieldwork in which a given species was recorded) as a proxy for relative abundances were excluded. Error bars represent the 95% confidence intervals of the mean proportion of hummingbird species in each abundance-generalisation category as predicted by 1000 null networks. Red circles show the empirically observed mean proportion of hummingbird species in each category. If the red circle is within the error bars, there were no significant differences between the observed proportions and the neutrality null model proportions. Percentages in the top left of each panel give the proportion of networks where empirical proportions were not significantly different from the null model proportions. Results are shown for each network (A-S, excluding B, K, L and M) and for each generalisation metric (Degree, Normalised degree,  $g$ ).

## References

- Vizentin-Bugoni, J. et al. 2014. Processes entangling interactions in communities: forbidden links are more important than abundance in a hummingbird-plant network. - Proc. R. Soc. B Biol. Sci. 281: 20132397.