

Thierry, A., Petchey, O. L., Beckerman, A. P., Warren, P. H. and Williams, R. J. 2011. The consequences of size dependent foraging for food web topology. – *Oikos* 120: 493–502.

Appendix 1

Comparison of webs where connectance was fixed and where it was allowed to vary

Methods

We created a second collection of food webs to look at (1) how connectance would vary as we changed the other parameters and (2) what effect relaxing this constraint would have on the size structure of the webs. The dataset contained both webs where a was (1) fixed, so connectance could vary and (2) varied to fix connectance. The parameters were not varied factorially (as in the first collection), rather the values of the seven parameters were set at $a_i = -4.2$, $a_j = -1.9$, $b = 0.24$, $C_i = 0$, $C_j = 0$, $\sigma = 6.5$. Each of the parameters (excluding connectance) was varied in turn at five different levels, which were evenly spaced between the largest and smallest values in Table A1. One hundred replicates of both variable and fixed connectance were made for each level of each parameter as it was varied.

Results

Which parameters affected connectance?

When a was fixed two parameters had particularly dramatic effects on connectance, increasing σ resulted in the webs being more connected and increasing a_j resulted in the webs being less connected. Increasing b and a_i both slightly increased connectance. Whilst altering C_i and C_j made little difference to the connectedness of the webs (Fig. A1).

What effect did allowing connectance to vary have on size structure?

GMC

There were large effects of allowing connectance to vary on GMC (Fig. A2). However all these changes were consistent with the changes we see in connectance. GMC was found to increase in the main analysis (Fig. 1), and this is still the case. So that whilst we found that increasing a_i was positively related to GMC as opposed to the previous pattern of a decrease in GMC with increasing a_i , this can be seen as consistent with the increase we found

in connectance. Likewise, the parameters b and σ that increased connectance as they increased, and which had some but limited effect on GMC when connectance was fixed, were now seen to have much larger effects. And in the same way we can understand that there was no alteration to this aspect of size structure in the effect of C_i and C_j , because they did not greatly alter connectance. Whereas a_j 's (which decreased connectance) effect of decreasing GMC was exacerbated.

VMC

Initial inspection of the patterns of differences revealed some trends which were harder to explain than those of GMC. The main analysis (Fig. 1) suggested that VMC should scale negatively with connectance, although there was no difference between the median values of VMC when connectance was 0.05 and when it was 0.1. The lack of effects of C_i and C_j could be accounted for in the same way as for GMC, by the fact that they had little influence on the value of connectance. The exacerbation of a_j 's negative relationship with VMC was also comprehensible.

There remained however three notable exceptions to our predictions of changes in size structure based on an expectation that VMC should decrease with increased connectance. These were that VMC did not decrease with increases in b despite an increase in connectance; that VMC decreased with increasing a_i despite connectance decreasing and that for low values of σ (which had a positive relationship with connectance) VMC initially increased.

The explanation is that there was in fact a hump-shaped relationship between connectance and VMC, and that decreasing VMC below 0.05 (which was not looked at in the main analysis) caused VMC to become more negative. This relationship accounts for why VMC initially increased with increases in a_j and σ before decreasing despite their opposite effects on connectance. The range of values of connectance which were encountered whilst altering b happened to lie at the peak of the hump and therefore there was little effect of b seen on VMC.

In summary we can say that there appeared to be little effect of fixing connectance for the overall trends, as the differences between the patterns with GMC and VMC of the fixed compared to variable connectance webs, could be accounted for by the effects on connectance. However, a new contingency between a_i and connectance was found which does not seem to fit with the patterns in Fig. 1 and 2 of the main analysis. This subsequent analysis also revealed a previously unnoticed hump-shaped relationship between connectance and VMC, whilst confirming the positive relationship of connectance with GMC. However there remains a caveat, we cannot be certain that these patterns are not particular to the set of parameters used.

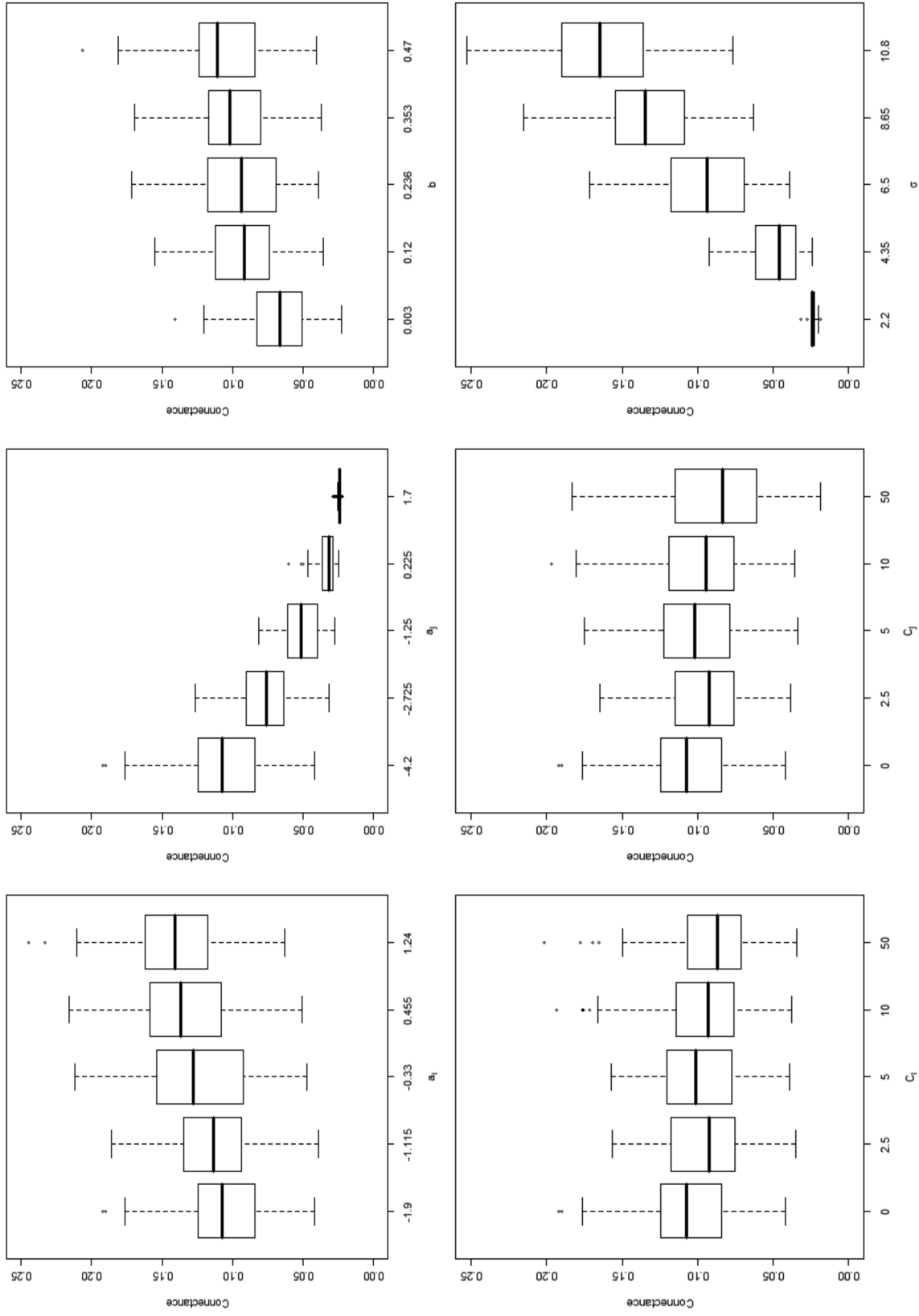


Figure A1. The variation in the connectance of the model webs were the constant a was fixed as the different parameters were varied. Black lines represent the medians and the boxes demarcate the 25–75% intervals.

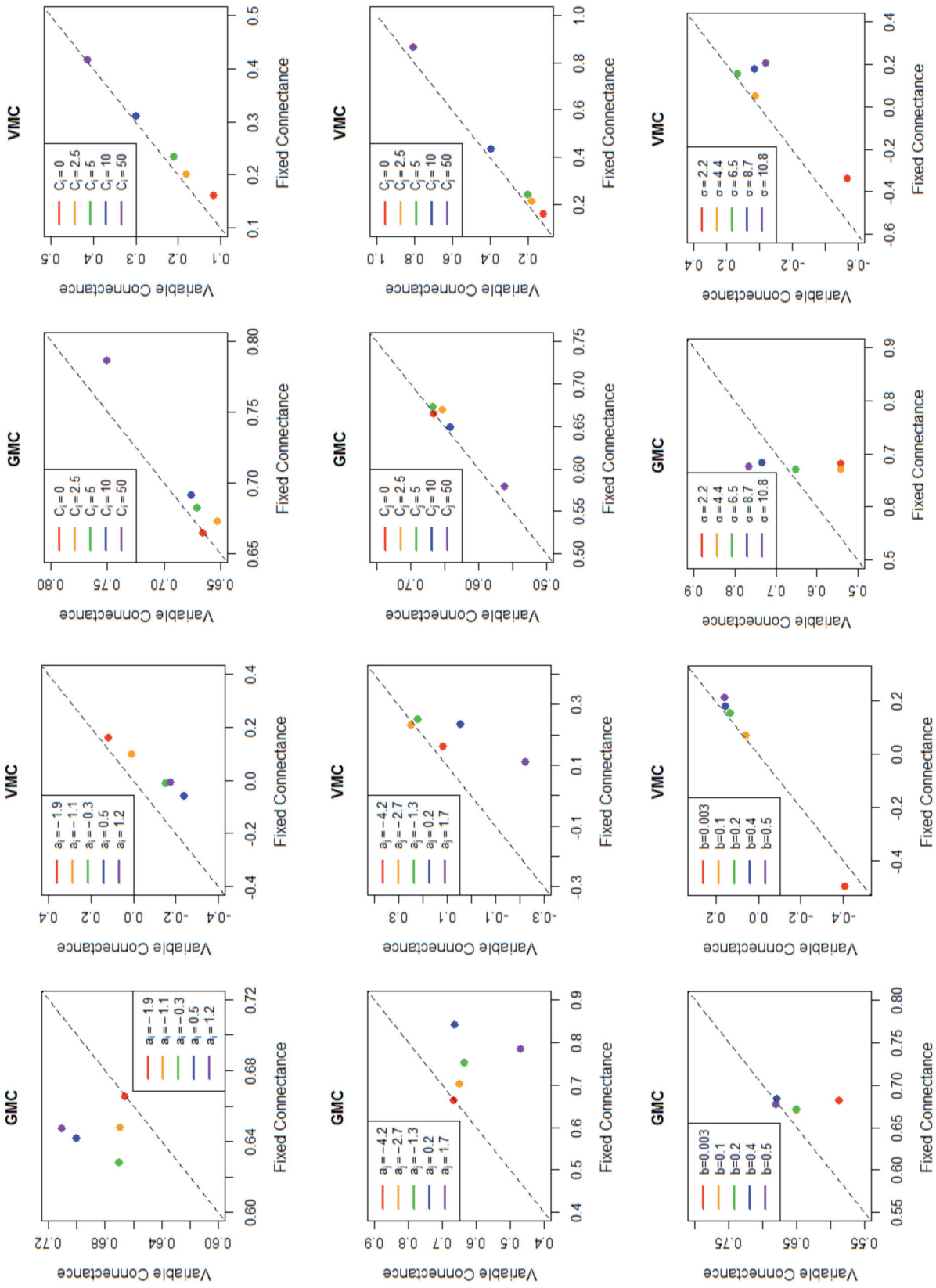
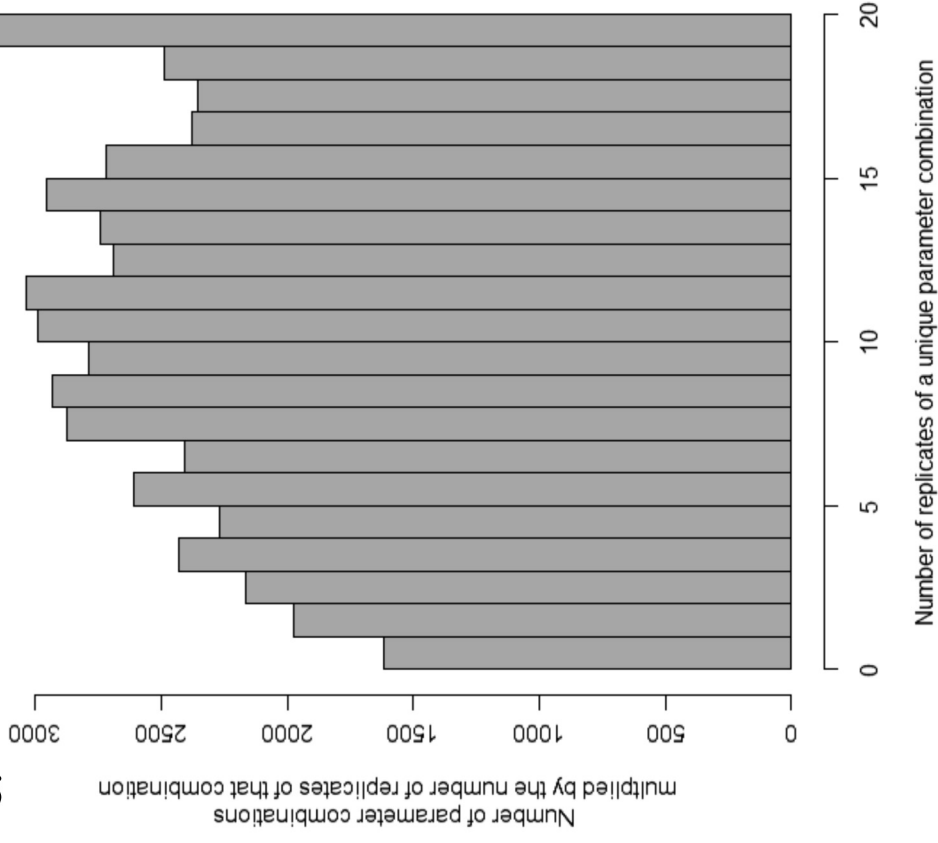


Figure A2. The values of GMC and VMC for webs with fixed connection plotted against their counterparts with variable connection, for each of the six parameters.

b.



a.

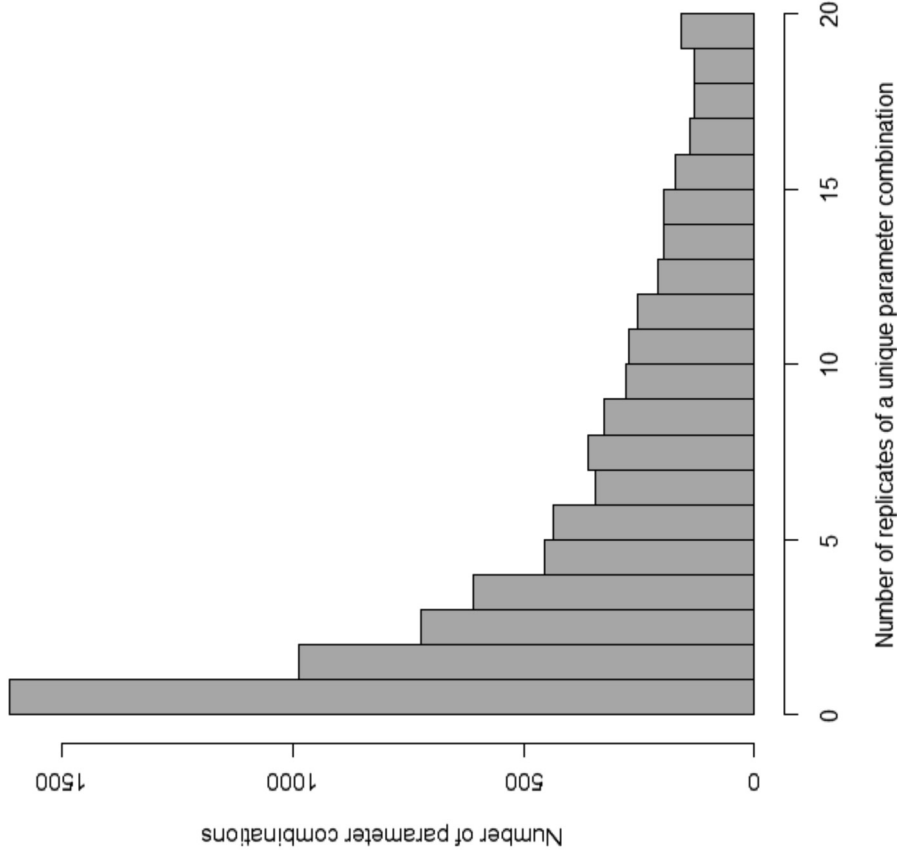


Figure A3. (a) The number of parameter combinations (within the specified variation of GMC and VMC) represented by different numbers of replicates, $n = 7985$. (b) The same as a, except the parameter combinations are multiplied by the number of replicates of each.

Table A1. Values of the three topological allometries for the 16 empirical webs.

Web	GMC	VMC	TLMC
Benguela	0.58	-0.15	0.24
Broadstone	0.36	-0.65	0.39
Broom	0.27	-0.09	0.20
Carpinteria	0.33	-0.59	0.2
Caricaie Lakes	0.23	-0.33	-0.05
Coachella	0.57	-0.28	0.31
EcoWEB41	0.57	-0.49	0.39
EcoWEB60	0.22	-0.17	-0.05
Grasslands	0.28	0.29	-0.07
Mill Stream	0.60	-0.73	0.40
Small Reef	0.38	-0.50	0.26
Sierra Lakes	0.66	-0.18	0.53
Skipwith Pond	0.37	-0.14	0.37
Tuesday Lake	0.61	-0.39	0.32
Ythan	0.35	-0.56	-
Weddell sea	0.27	-0.61	-