HIERARCHICAL PARTITIONING

Hierarchical partitioning allows the contribution of each predictor to the total explained variance of a regression model, both independently and in conjunction with the other predictors, to be calculated for all possible candidate regression models. Consider a predictor variable x_k. The independent contribution of x_k is calculated by comparing the fit of all models including x_k with their reduced version (i.e. the exact same model but with x_k omitted) within each hierarchical level. The average improvement in fit for each hierarchical level that considers x_k is then averaged across *all* hierarchies, giving the independent contribution of x_k (Quinn and Keough 2002). The measure of fit to use is dependent upon the type of predictor variables being used (i.e. continuous, logistic, etc.). Joint effects are those caused due to the multi-collinearity between predictors that Mac Nally (2002) cites as restricting the explanatory power of the 'best' multiple regression model. The contribution (to the total explained variance of a model) of a predictor in conjunction with all others is found simply by subtracting the total variance explained by a predictor independently (as found above) from the total variance explained by the predictor alone (i.e. the total variance explained by that predictor in a univariate regression model – models 2, 3, or 4 in Table 1). Thus, hierarchical partitioning does not produce any kind of predictive model. Rather it allows identification of the predictors that explain most variance independently of the others, helping to overcome the problems presented by multi-collinearity. Hierarchical partitioning will be used here to assess the amounts of variance attributable to each predictor variable (purpose one of the two suggested by Mac Nally, 2002, as common uses for multiple regression models).

Table 1. Models and hierarchies for a model with three predictor variables. These hierarchies do not consider possible parameter interactions (i.e. $X_1.X_2$). By splitting models into hierarchies as shown all possible candidate models can be compared simultaneously. Source: Quinn and Keough (2002).

Label	*Model*	*Level of Hierarchy*
1	No Predictor variables (intercept only)	0
2	X_1	1
3	X_2	1
4	X_3	1
5	$X_1 + X_2$	2
6	$X_1 + X_3$	2
7	$X_2 + X_3$	2
8	$X_1 + X_2 + X_3$	3

References

Mac Nally R. 2002. Multiple regression and inference in ecology and conservation biology: further comments on identifying important predictor variables. Biodiversity and Conservation 11:1397-1401.

Quinn GP and Keough MJ. 2002. Experimental design and data analysis for biologists. Cambridge University Press: Cambridge.