Supplemental Methods for Estimating Piecewise Functions

In order to test whether top predator (TP) biomass predicts herbivore (HE) biomass differently over certain ranges of top predator biomass, I used non-linear least squares to estimate the cut point and then used ordinary least squares to estimate a piecewise function. The model I estimated using non-linear least squares was:

$$HE = (a_1 + b_1 TP) * (TP < c) + (a_1 + b_1 TP + b_2 (TP - c)) * (TP \geq c)$$

where a_1 is the intercept, b_1 and b_2 are slopes, and c is the unknown cut point. The non-linear least squares estimate of the cut point was 0.81 mT/ha (95% CI: 0.16, 1.44).

I then used the estimate for the cut point to generate a new variable, TP_c where $TP_c = TP - c$ if $TP \geq c$ and $TP_c = 0$ if $TP < c$. This new variable allowed me to estimate the piece wise function:

$$HE = a_2 + b_3 TP + b_4 TP_c$$

where a_2 is the intercept and b_3 and b_4 are slopes. The ordinary least squares estimate of the slope for values of TP less than the cut point was 0.41 ($p<0.01$) and for values of TP greater than or equal to the cut point was -0.10 ($p=0.63$).

I repeated these methods in order to test whether large-bodied fish biomass predicted small-bodied fish biomass differently over certain ranges of large-bodied fish biomass. The non-linear least squares estimate of the cut point was 2.04 mT/ha (95% CI: 1.16, 2.90). The ordinary least squares estimate of the slope for values of large-bodied fish less than the cut point was 1.07 ($p<0.001$) and for values of large-bodied fish greater than or equal to the cut point was -0.20 ($p=0.61$).