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EDITED AND REVIEWED BY
Thomas John Hossie,
Trent University, Canada

*CORRESPONDENCE

Mark Novak

✉ mark.novak@oregonstate.edu

[†]These authors have contributed equally to this work

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Corrigendum: Geometric complexity and the information-theoretic comparison of functional-response models

Mark Novak^{1*†} and Daniel B. Stouffer^{2†}

¹Department of Integrative Biology, Oregon State University, Corvallis, OR, United States, ²Centre for Integrative Ecology, School of Biological Sciences, University of Canterbury, Christchurch, New Zealand

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A Corrigendum on

Geometric complexity and the information-theoretic comparison of functional-response models

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Due to an error in our formulation of the citardauq solution to quadratic equations, our reformulation of the Steady State Saturation (SSS) model of [Jeschke et al. \(2002\)](#) to a more traditional Holling-type form was incorrect. The incorrect equation that we used in our analyses and gave in **Table 1** was

$$\frac{2aN}{1 + a(b+c)N + \sqrt{(1 + a(b+c)N)(1 + a(b+c+4bc)N)}}$$

The correct equation is

$$\frac{2aN}{1 + a(b+c)N + \sqrt{1 + aN(2(b+c) + aN(b-c)^2)}}$$

The latter equation is equivalent to the quadratic solution originally given by [Jeschke et al. \(2002\)](#) as

$$\frac{1 + a(b+c)N - \sqrt{1 + aN(2(b+c) + aN(b-c)^2)}}{2abcN}$$

Correcting the error affects the SSS-specific panel of **Figure 5**, as well as **Figures S4, S8, S12, and S16** of the **Supplementary Material**. To permit comparison between the correctly calculated geometric complexity of the SSS and that of the 18 other three-parameter models that we considered, we here include the corrected **Figure 5** in its entirety. The

Supplementary Material has been updated in the original article. All the panels in these figures that pertain to models other than the SSS remain unchanged.

Using the correct equation for the SSS does not change our primary inference that the SSS is less flexible (i.e., has lower geometric complexity) than the baseline Holling-Real Type III (H3R) model and most other prey-dependent three-parameter models. However, the corrected SSS model has similar (rather than much lower, as previously stated) flexibility compared to the

other least-flexible Abrams II (A2) model. Furthermore, the correction makes the effects of different experimental designs on the flexibility of the SSS more consistent with the effects seen for the other prey-dependent models: for both a golden-ratio (Figure 5) and an arithmetic spacing (Figure S8) of prey and predator abundances, (i) increasing maximum prey abundance causes the difference between \mathcal{G}_{SSS} and \mathcal{G}_{H3R} to decrease (rather than increase, as previously stated), with (ii) variation in maximum predator abundance having a weak effect on their

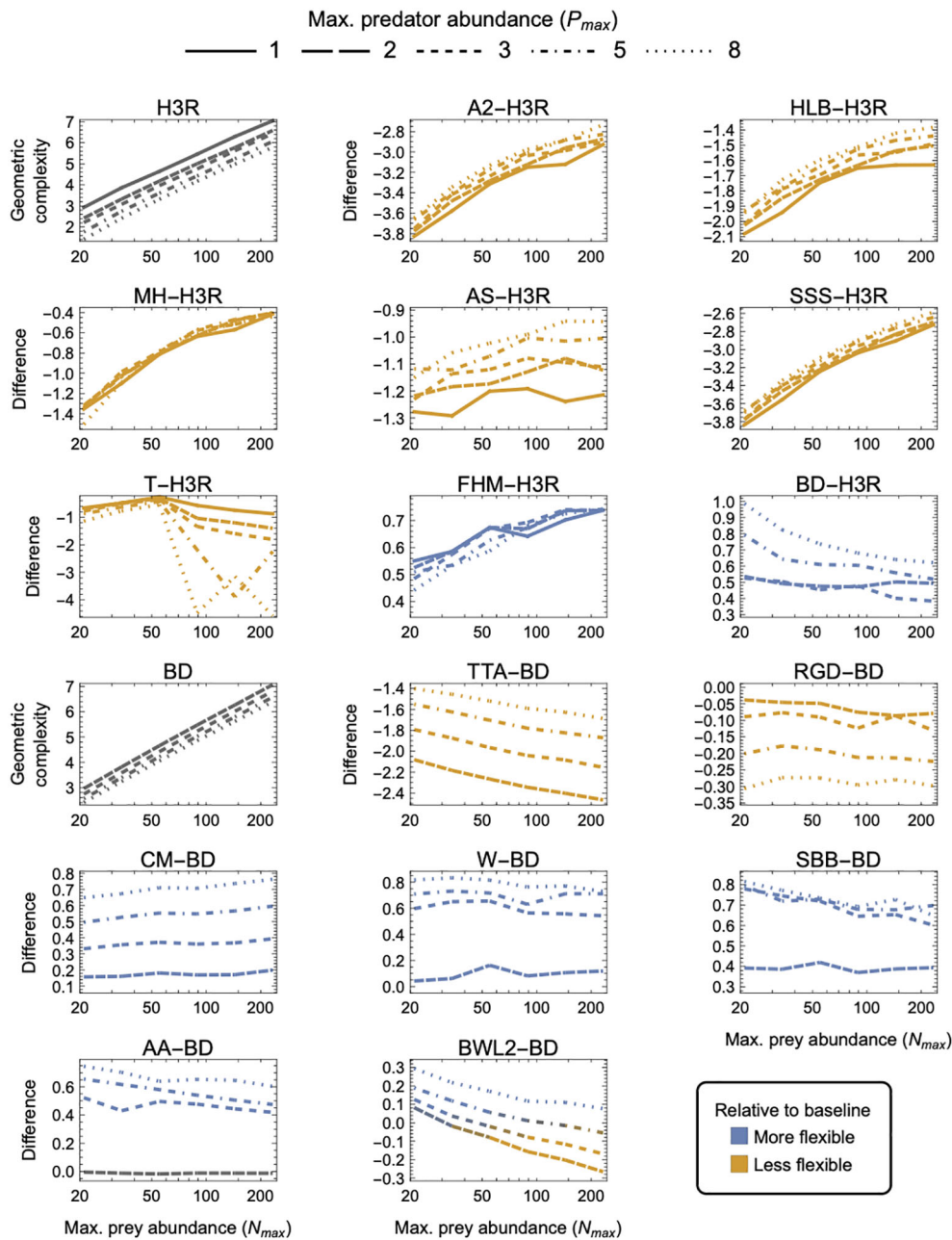


FIGURE 5
 As in Figure 3 but for three-parameter ($k = 3$) functional-response models. First and tenth panels: The geometric complexity \mathcal{G}_M of the baseline Holling-Real Type III (H3R) and Beddington-DeAngelis (BD) models as a function of the experiment's maximum prey and predator abundances (N_{max} and P_{max}). Other panels: The difference in \mathcal{G}_M of the other three-parameter prey-dependent (top two rows) and ratio- and predator-dependent (bottom two rows) models relative to the baseline models. As a visual aid, models with greater geometric complexity than H2 are colored in blue while those with less geometric complexity than H2 are colored in orange.

difference (rather than a large effect, as previously stated). Further, (iii) variation in the number of prey levels has a larger effect on the difference between \mathcal{G}_{SSS} and \mathcal{G}_{H3R} than does variation in the number of predator levels (Figure S4) (rather than a smaller effect, as previously stated). The correction does not change the conclusion that decreasing the minimum (Figure S12) or increasing the maximum (Figure S16) expected number of eaten prey (by an order of magnitude) has little to no effect on the inferences of our primary analysis.

In Section 3.4, paragraph 2 originally read:

For the ratio- and predator-dependent models, differences to BD were more sensitive to variation in P_{max} than to variation in N_{max} . The degree to which CM, W, SBB, and AA were more flexible than BD increased with increasing P_{max} , reaching a difference in geometric complexity of 0.8 information units at $P_{max} = 8$. For these models, the most equitable design therefore entailed small P_{max} regardless of N_{max} , but for TTA and RGD, for which the difference to BD decreased with increasing P_{max} , it was designs entailing large P_{max} which reduced their lower geometric complexity the least (by no less than 1.4 and up to 2.9 information units). The degree to which the prey-dependent AS, SSS and T models were less flexible than H3R was also more sensitive to variation in P_{max} than in N_{max} , but the degree to which A2, HLB, and MH were less flexible and the degree to which FHM was more flexible was relatively insensitive to variation in P_{max} . As N_{max} increased, SSS and T became less flexible than H3R, A2, HLB, MH, and AS became less inflexible relative to H3R, and FHM became more flexible than H3R. For BWL2, which could either be more or less flexible than H3R depending on design, the most equitable designs spanned those that had the largest considered N_{max} when P_{max} was large to those that had the smallest considered N_{max} when P_{max} was small. Overall, SSS and RGD exhibited the greatest potential disparity relative to their H3R and BD baselines, respectively differing in their geometric complexity by about 13 and almost 2.9 information units for the least equitable designs. The greatest potential disparity among all other considered three-parameter models was about 11 information units and occurred between SSS and CM for large N_{max} , large P_{max} designs in favor of CM.

This has been updated to read:

For the ratio- and predator-dependent models, differences to BD were more sensitive to variation in P_{max} than to variation in N_{max} . The degree to which CM, W, SBB, and AA were more flexible than BD increased with increasing P_{max} , reaching a difference in

geometric complexity of 0.8 information units at $P_{max} = 8$. For these models, the most equitable design therefore entailed small P_{max} regardless of N_{max} , but for TTA and RGD, for which the difference to BD decreased with increasing P_{max} , it was designs entailing large P_{max} which reduced their lower geometric complexity the least (by no less than 1.4 and up to 2.9 information units). The degree to which the prey-dependent AS and T models were less flexible than H3R was also more sensitive to variation in P_{max} than in N_{max} , but the degree to which A2, HLB, MH, and SSS were less flexible and the degree to which FHM was more flexible was relatively insensitive to variation in P_{max} . As N_{max} increased, T became less flexible than H3R, A2, HLB, MH, AS, and SSS became less inflexible relative to H3R, and FHM became more flexible than H3R. For BWL2, which could either be more or less flexible than BD depending on design, the most equitable designs spanned those that had the largest considered N_{max} when P_{max} was large to those that had the smallest considered N_{max} when P_{max} was small. Overall, A2, SSS and TTA exhibited the greatest potential disparity relative to their H3R and BD baselines, respectively differing in their geometric complexity up to almost 3.8 information units for the least equitable designs. The greatest potential disparity among all other considered three-parameter models was about 4.6 information units and occurred between A2, SSS and CM for small N_{max} designs in favor of CM.

Ironically, our error emphasizes the main message of our article that (functional-response) models of equivalent parametric complexity (i.e., having the same number of free parameters, just like the first two equations of this corrigendum) can differ in their geometric complexity (i.e., their flexibility) and thereby in their ability to fit data.

The authors apologise for these errors and state that they do not change the scientific conclusions of the article in any way. The original article has been updated.

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