

Clarifying the statistical basis and outputs of isotope mixing models: a response to Fry (2013)

Brice S. Semmens, Eric J. Ward, Andrew C. Parnell, Donald L. Phillips

Abstract

A recent article by Fry (2013; Mar Ecol Prog Ser 472:1–13) reviewed approaches to solving underdetermined stable isotope mixing systems, and presented a new graphical approach and set of summary statistics for the analysis of such systems. In his review, Fry (2013) mis-characterized the statistical basis and interpretation of outputs from commonly used mixing model tools. Furthermore, he used this mis-characterization to justify an alternate graphical approach to analyzing mixing models, including two new metrics for tracking source contributions to a mixture (Σ_{MIN} and % resolved). Here, we provide a more accurate description of the analytic theory underlying common mixing model approaches. Additionally, we provide an analysis of the 4 source, 2 tracer underdetermined mixing system example introduced by Fry (2013) using both a Bayesian mixing model and his graphical analysis and summary metrics in order to demonstrate that, when properly interpreted, Bayesian approaches yield more intuitive and informative sets of parameter estimates. Nonetheless, we agree with Fry (2013) that isotope data should always be plotted as part of the mixing model analysis.