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Modelling mixotrophy; more or less the sum of the parts?

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Abstract

Mixotrophs are significant components of planktonic food webs and are frequently associated with harmful algal bloom events; it is thus important that they are described in coastal ecosystem models. There are, however, insufficient quantitative data to support the construction and testing of simple empirical descriptions of mixotrophs. Here, a complex model based upon our phenomenological understanding of these organisms (Flynn and Mitra, 2009) was run under different scenarios in order to generate a control "reality" against which to compare contrasting simple descriptions of mixotrophy. The simplest description, adding together phototrophic and heterotrophic functions gave the worst output. The best simple model tested used phototrophy as a top-up mechanism for heterotrophy, a mode in keeping with the evolution of these organisms. However, none of the simple models could describe kleptochloroplasty – an important process in harmful bloom species. A point of concern is that none of the simple models could correctly match the balance of phototrophy and heterotrophy; while the fit to the bulk parameters of biomass and nutrients could be acceptable, the rate processes were completely in error. The implication from this study is that a fit to bulk data gives no assurance that the model structure is not dangerously dysfunctional.

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