

Frontiers abstract

Isotopic incorporation and the temporal dynamics of foraging among individuals and within populations

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Consumer-resource relationships result from complex interactions between consumer and prey densities, behavioral norms, and habitat characteristics. Many of these ecological and environmental states are time-dependent, such that the resultant consumer-resource interactions are themselves dynamic. Estimation of consumer diet from stable isotope analysis uniquely integrates dietary signals over different **timescales**, dependent on tissue type. However, the relationships between dietary dynamics at both the individual and population levels and the expression of such behaviors via the incorporation of isotopic ratios over different timescales has received little theoretical attention, although they have been considered in depth separately. Here we **employ** stochastic process models to establish a theoretical framework **that combines** the physiological incorporation of **isotopic ratios** from prey resources with density-dependent foraging dynamics **of the consumer**. Our approach allows us to relate the temporal dynamics of foraging to changes in the mean and variability of consumer isotopic ratios as a function of different tissue incorporation rates, with respect to both within- and among-individual dietary variability. We also establish mechanistic links between population and dietary dynamics of a **diverse** consumer-resource system, **and quantify dependencies between the timescales of isotopic turnover and prey switching behaviors**. We examine the utility of this approach by showing how known foraging dynamics of sea otter populations impacts consumer isotopic distributions over time, as well as to what extent the variability of consumer and resource isotopic ratios can be informative of different foraging dynamics. We suggest that incorporating elements of consumer foraging behaviors, such as prey switching dynamics, with models of tissue-specific isotope incorporation, can help elucidate ecological relationships between consumers and their potential prey.