Quantifying Foraging Success To quantify the consumers’ ability to track the distribution of their resources over space and time, we use the continuous form of the Bhattacharya Coefficient (BC; Bhattacharyya 1943) for quantifying the overlap between two distributions. Because the BC was initially formulated for use with probability distributions, we use a normalized form. Specifically, we have

. (19)

The timeframe *t’* to *tmax* represents some period after transient behaviors have settled down. For static resource distributions, which (with appropriate boundary conditions of mass conservation) always exhibit an equilibrium solution, the integral is only over space (Fagan et al. 2019). For dynamic landscapes, such as periodically fluctuating landscapes on which we focus, the time integral needs to be taken over a long enough period to discount the transient behaviors and instead capture long-term variation (Fagan et al. 2017). This metric of foraging success differs from that used in Fagan et al. (2017, 2019), but the change is necessary to accommodate comparison across all six of the scenarios we consider here.

Equation (19) quantifies ‘resource matching’ in the sense that foragers must spatially and temporally overlap with resources to be successful. Because our work deals only with animal movement behavior and not population growth or decay, we do not consider mutual interference or resource depletion. This is a reasonable assumption when population density is low (i.e., sparsely populated regions) and resources are ephemeral (i.e., resources degrade before their density can be reduced much by the foragers). In these systems, the question is more about capitalizing on transient resources, as opposed to avoiding competition. Such transient resource dynamics characterize, for example, the Eastern steppes of Mongolia that have motivated much of our earlier work on animal movement (Mueller and Fagan 2008, Mueller et al. 2011, Martínez-Garcia et al. 2013, Fleming et al. 2014).

In the above, u + v is the density of the consumers, and m is the density of the true resource