

Spatial Scales of Population Synchrony Increase as Fluctuations Propagate through the Food Web

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The spatial scale of population synchrony gives the characteristic size of the regions where population fluctuations are correlated, thus, of simultaneous population depletions (or even extinctions). Single-species previous results imply that the spatial scale of population synchrony is equal or greater (due to dispersion) than the spatial scale of synchrony of environmental fluctuations. Interspecies interactions are known to modify the spatial scales of population synchrony, as it is primarily found in a case-by-case computational approach. Here, we show analytically that the spatial scale of population synchrony generally increases as the fluctuations propagate through the food web, i.e., the species more directly affected by environmental fluctuations presents the smaller spatial scale of population synchrony. This result is shown here for two species ecosystems close to a stable equilibrium of their population dynamics. The relevance of the result is discussed based on previously reported observations on marine and terrestrial ecosystems.

Spatial scales of population synchrony increases along the main direction of propagation of the fluctuations along the food chain, $l_e < l_A < l_B$

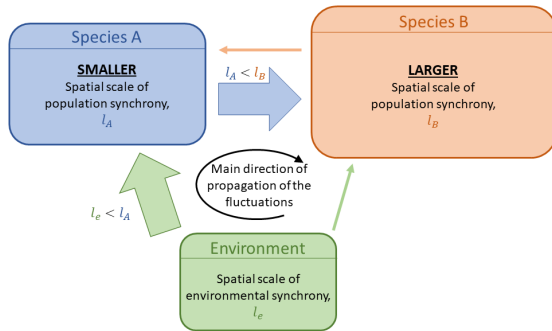


Fig. 1. Spatial scales of population synchrony increases along the main direction of propagation of the fluctuations along the food chain, $l_e < l_A < l_B$.

[1] Fernandez-Grande, M.A., Cao-Garcia, F.J. *Spatial Scales of Population Synchrony generally increases as fluctuations propagate in a Two Species Ecosystem*, <https://arxiv.org/ftp/arxiv/papers/2012/2012.11043.pdf> (2020).

[2] Jarillo, J., Saether, B.-E., Engen, S., Cao-Garcia, F.J. *Spatial scales of population synchrony in predator-prey systems*. *Am. Nat.*, 195, 216-230 (2020).

[3] Jarillo, J., Saether, B.E., Engen, S., Cao, F.J. *Spatial scales of population synchrony of two competing species: effects of harvesting and strength of competition*. *Oikos*, 127, 1459-1470 (2018).