When is dispersal for dispersal?

Dr. Scott Burgess

Department of Biological Science, Florida State University

Email: sburgess@bio.fsu.edu

Web: http://scottburgessecology.wordpress.com

- We study the evolutionary ecology and population dynamics of marine invertebrates (such as bryozoans, marine snails, oysters, and corals)
- Dispersal, the movement of organisms from where they were born to where they later reproduce, is important because it influences population connectivity and persistence[1] (Fig. 1), as well as the fitness of individuals
- Dispersal is usually thought to evolve as a way to reduce competition with kin, avoid fitness costs of inbreeding, or to escape temporally or spatially deteriorating conditions
- Recent syntheses of dispersal evolution have focused on dispersal as a direct adaptation, but much of the dispersal seen in marine invertebrates living on the seafloor probably occurs as an incidental by-product of selection to exploit open water environments for early development, rather than directly for dispersal[2].
- We are conducting research to better understand the causes and consequences of marine dispersal, so that we can better predict how marine populations persist under environmental variation and change (Fig. 2).

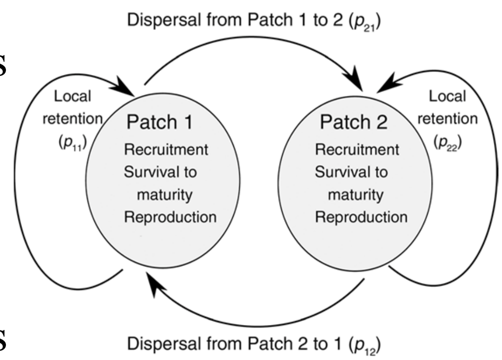

Fig. 1: There are two routes to population persistence when there are multiple patches: self persistence and network persistence. Shown here is the flow of individuals between patches (p_{ij} and p_{ji}) and their survival and reproduction within patches. The logic here extends to multiple patches. Self-persistence occurs when local populations persist independently due to local retention, even though connectivity may still occur. Network persistence occurs when local populations persist through both local retention and closed loops of connectivity between patches. Only the connectivity that leads to closed loops of replacement contributes to persistence.

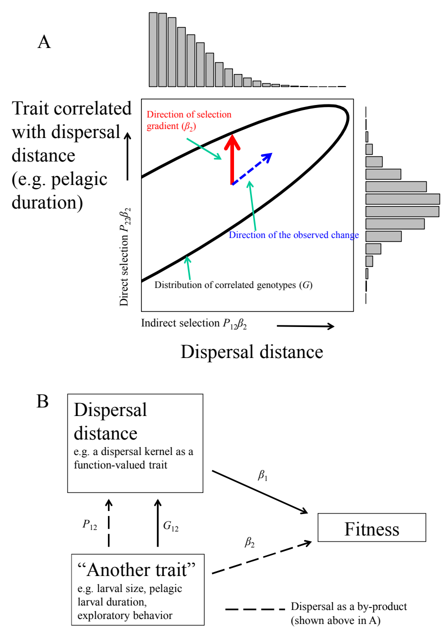

Fig. 2. A framework to address the question ‘when is dispersal for dispersal?’ (A) The observed evolutionary response of dispersal distance as a by-product of selection on another correlated trait can be represented mathematically as $\Delta z_1 = G_{11}P^{-1}_{11}(P_{12}\beta_2) + G_{12}P^{-1}_{12}(P_{22}\beta_2)$. (B) Hypothetical causal relationships (arrows) between a trait, dispersal distance, and fitness. The solid lines show dispersal ‘for’ dispersal. The dashed lines (situation shown in A) represent dispersal as a by-product. Both the statistical associations between phenotypes and fitness (A) and experimental approaches to identify the causal links between phenotypes and fitness (B) are required to understand the degree to which dispersal is for dispersal.

[1]**Burgess SC**, Nickols KJ, Griesemer C, Barnett LAK, Dedrick A, Satterthwaite E, Yamane L, Hastings A, Morgan SG, White JW, Botsford LW (2014) Beyond connectivity: how empirical methods can quantify population persistence to improve marine protected area design. ***Ecological Applications*** 24: 257-270

[2]**Burgess SC**, Baskett ML, Grosberg RK, Morgan SG, Strathmann RR. (2015) When is dispersal for dispersal? Unifying marine and terrestrial perspectives. ***Biological Reviews***. DOI: 10.1111/brv.12198