**Week 5: Dispersal**

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| **18 groups** | **76+ participants** |

**Summary:** Groups discussed dispersal based on papers by Pringle and Wares (2009, *Marine Ecology Progress Series*) and Connolly et al. 2001 (*Ecology*)

**1. How might pelagic life histories with asymmetrical dispersal, coupled with genetic correlations between larvae and adult traits, constrain or promote adaptation?**

* Whether or not genetically correlated life stages promotes or constrains adaptation in an asymmetrically dispersed population depends on a variety of factors:
  + Life stage affected: If a trait is beneficial to larvae but harmful for adults, adaptation may be constrained. Positive selection on linked, beneficial traits should promote adaptation.
    - Function of traits under selection and trait redundancy important
    - Differential fitness across life stages could lead to evolutionary mismatches
  + Where is the trait beneficial? If a trait is beneficial downstream but not upstream, gene flow may swamp out even favored alleles.
  + Duration of larval dispersal: Shorter durations could improve retention of local phenotypes which would promote adaptation especially in beneficial traits
  + Strength of selection may be decoupled across life stages which is important given tension between migration/selection balance.
  + Genetic diversity of upstream populations: For example, species that mass spawn likely to produce greater genetic variation compared to species that mate with fewer partners
* Restrictions in gene flow (e.g., barriers) of asymmetric dispersers should promote local adaptation given selection (tilt migration/selection balance)
  + High connectivity and strong asymmetrical dispersal will slow downstream adaptation by dragging allele frequencies away from downstream optimum.
  + Anything that impedes the ability of larvae to reach, survive in, or reproduce in downstream habitats should promote local adaptation
  + Biotic factors: Reduced time spent dispersing, behaviors/traits that improve retention of local phenotypes, negative density dependence in downstream sites (competition) reduced downstream habitat availability (priority effects), increased larval predation
  + Abiotic factors: Oceanographic features such as upwelling, advective currents, or gradient in abiotic features, isolation by distance, as well as physical boundaries.
* Historic or geologic processes could shift clines if mechanism maintaining them is removed.
  + Possible that clines have moved or are moving given climate change/ sea level rise
* Logistical issues in research: Larval stage dispersal very difficult to study. We may also misidentify selection as driver of divergence, when in fact the driver of adaptation is the presence of barrier.

**2. When and where do we expect population genetic structure to be generated and/or maintained?**

* In general, as barriers to dispersal decrease, the strength of selection would need to increase to maintain population structure.
  + The strength of selection and the efficiency of barriers is complex
    - Strong selection more likely to create genetic cline
    - Barriers (as listed above) likely to maintain differentiation of even neutral traits
    - High gene flow likely to reduce genetic differentiation
  + Complexity relates to pelagic larval dispersal duration, environmental heterogeneity, timing and efficiency of biotic and abiotic barriers (i.e., whether they disrupt recruitment pre- or post-settlement), strength of selection across traits and life stages, migration distance, variation in effective population size, variation in habitat quality, etc.

**Key Unknowns:**

* Need to better understand heterogeneous landscape of selection relative to migration across seascapes. Understudied sources of complexity are listed above.
* Differential impacts of historic vs. contemporary environmental change. Historic evolution likely has strong impact on evolutionary trajectories