**Week 7: Genetic Load**

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| **15 groups** | **83+ participants** |

**Summary:** Groups discussed papers about expansion load during range expansion (Gilbert et al. 2017, American Naturalist) and phenotype-environment mismatches in the sea (Marshall et al. 2009, Ecology Letters).

**1. What’s the relationships between phenotype-environment mismatches and genetic load?**

* In marine environments, phenotype-environment mismatches (PEM) should increase mortality in migrating foreign larvae. This could lessen genetic load by inhibiting maladaptive alleles from being introduced.
  + PEM reduces connectivity and gene flow, which allows more time and opportunity for local adaptation in edge populations
  + May be opposite in terrestrial environments whereby PEM increases migration load
* Contingent on:
  + Environment – Scale and intensity of environmental gradient
    - Decreased gradient should increase expansion, decrease PEM, and increase genetic load.
    - Multiple environmental gradients should also have impact
    - Temporal and spatial heterogeneity are important
      * Continuous vs. patchy heterogeneity
  + Phenotypic plasticity – plasticity could allow maladapted individuals to survive for longer in new environment, increasing genetic load.
    - Temporal heterogeneity may harbor more plastic phenotypes than spatially heterogenous environments
  + Dispersion – rates/frequency of dispersal, type of dispersion, life history stage, time scales, physiological debts of dispersal
  + Assumptions – assumes abundant center/core distribution, foreign individuals always maladapted to new environment, selective agent driving mortality during migration matches selective agents in new environment, linear gradients
  + Logistics – challenging to sample and quantify genetic load and model assumptions
* Application for Marine Protected Areas (MPAs): If MPAs are smaller than scale of environmental heterogeneity, could be ineffective due to PEM or increased migrant load.
  + To reduce genetic load/PEM in MPAs, perhaps better to have many smaller MPAs chosen according to environmental heterogeneity

**2. How does dispersal scale and the scale of environmental heterogeneity contribute to genetic load?**

* Dispersal scale and scale of environmental heterogeneity both affect genetic load. Increasing scale of dispersal increases probability that individual will
  + If scale of dispersal is *less* than scale of environmental heterogeneity, expect genetic diversity to be maintained with little genetic load
    - Connectivity and gene flow should be reduced, lower expansion load.
  + If scale of dispersal is *greater* than scale of environmental heterogeneity, expect further dispersal success which will increase genetic load.
  + Alternatively, further distances could increase probability of encountering environment for which it is mismatched
    - If organisms are maladaptated to environmental heterogeneity, expect increased PEM which will slow expansions and decrease genetic load

**Key Unknowns:**

* Application of modeling results: Can we test and measure assumptions of these models?
* Implications for MPAs: What is optimal strategy if the goal is to reduce genetic load for organisms in MPAs?