**Results**

*Drift scenario 1 and migration*

Imposing a gradient in carrying capacity across the landscape lead preferentially to the formation of positive clines (i.e. less HCN in urban populations). The mean slope of clines across 1000 simulations was always positive in the presence of spatial drift gradients, although the mean slope became gradually weaker with increasing minimum urban population size (Figure 3A). Similarly, positive clines occurred with much greater frequency under strong drift gradients; negative clines only occurred at the highest minimum population size and occurred at the same frequency as positive clines in the absence of spatial gradients in drift (Figure 3B).

Migration reduced the mean strength of clines and the proportion of significantly positive clines. Under a strong spatial gradient in drift (minimum *N* = 10), the strongest clines in the frequency of HCN occurred with little to no migration while increasing migration reduced the mean slope of clines to near zero (Figure 3C). In contrast, the mean strength of clines at each of the two unlinked loci (i.e. *CYP79D15* and *Li*) was consistently zero, independent of migration rate. Finally, increasing migration generally reduced the proportion of significantly positive clines and negative clines only occurred when migration was highest (Figure 3D).



**Figure 3:** Effects of migration and spatial gradients in drift on the formation of clines in HCN. Spatial gradients in drift—controlled by varying the minimum urban population size across the landscape matrix—influenced (A) the mean strength of clines across 1000 simulations and (B) the proportion of significantly positive (open squares) and negative (filled diamonds) clines. When there is a strong gradient in drift (minimum *N* = 10), migration influenced the mean strength of HCN (filled diamonds) clines, but not clines in *CYP79D15* (open triangle) or *Li* (grey inverted triangle) (C). Similarly, (D) migration influence the proportion of significantly positive (open squares) and negative (filled diamonds) clines. All points represent mean or proportions ± 95% confidence intervals.