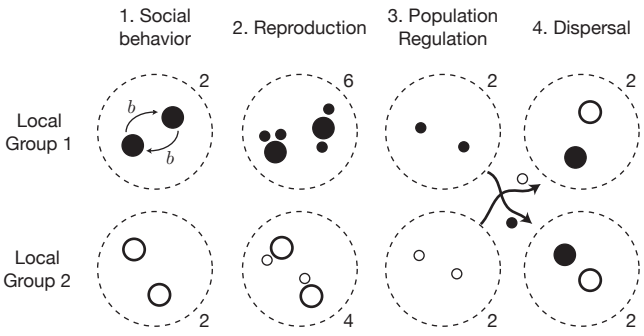


(a) Global competition



(b) Local competition

Figure 3.5: Filled circles represent altruists. Hollow circles represent nonaltruists. Numbers next to each dashed circle are counts of individuals in each local group at each stage in the life cycle. We assume in these examples that the environment limits the number of adults in each local group to two. Dispersal transfers half of each local group. (a) When dispersal occurs after social behavior but before population regulation, altruists can spread. This is because groups with more altruists contribute more migrants to the population migrant pool. New local groups are drawn largely at random from migrants, and once population regulation acts to reduce the number of offspring each generation, altruists are likely to compete with individuals other than those they originally cooperated with. (b) When dispersal occurs after population regulation (pictured) or is limited (discussed in the text), altruism is harder to evolve. Altruists might help one another, but they must later compete with one another before dispersal mixes the survivors of local groups.