## Methods

### Model overview

The evolutionary individual-based simulation models a population of haplodiploid organisms over 1,000,000 arbitrary time units. Each simulation starts with identical solitary breeding females (, can be appropriated as nests). Through their adult life, each individual is updated individually, wherein they perform a task choice between foraging and breeding at every update.

### Life cycle

Each simulation begins with mated, solitary foundresses. Whenever an individual is to be updated, it finishes its previous task and performs a task check between foraging and brooding for the next update time. Adult females have a survival probability and for each instance of brooding and foraging respectively.

If the individual’s current task is brooding, then a larva is added to the female’s nest at the next update. The gender of the larva is determined by a constant sex ratio (0.5 unless stated otherwise). If the current task is foraging, a random larva from the nest is chosen and is allocated resources in the next cycle.

### Dispersal

\_\_ Enter parts about spline \_\_. This dispersal propensity is logistically transformed to a dispersal probability. All simulations start with high dispersal probability 0.98. Hence, we start each simulation with solitary breeding prevalent through the individuals (unless stated otherwise). If a disperser does not find an empty nest in the existing instances, it dies.

### Task Choice

\_\_ Enter parts about splines \_\_

### Resource allocation and larval maturation

A foraging female that survives the task allocates a resource value sampled from a normal distribution (mean = ; std =) to a random larva in the same nest. The larva matures if it’s body size is larger than maturation threshold ( value ). Females are monogamous and mate once in their entire life. Mature females select a male at random from the available pool; they stay unmated till males are available otherwise. Non-disperser females stay in the same nest, while disperser females search for an empty nest. Mature males are assigned a lifespan from an exponential distribution (lambda = ) and pooled together across nests.

### Genetics and mutation

Haplodiploid sex determination is implemented, such that females are diploid, and males are haploid. <<Insert gene details and what they do>>. Whenever a new larva is born, mutations occur by the per-locus mutation rate (value). If a locus undergoes mutation, the gene value is altered by mutation step size <<Ella had normal sampling here>>. Recombination can occur during gene transmission to offsprings. Genes are expressed in females, with males functioning as gene carriers. The two homologous loci in females act additively, and are averaged to obtain the phenotypic values << Again confirm with Ella’s>>

### Model analysis

The model was constructed in C++ and compiled with g++ <<check version>>.

\_\_ details about analysing population equilibria, check with Ella \_\_

All data analysis and plotting was performed in R v4.3.1 using R packages <<insert>>