|  |  |  |
| --- | --- | --- |
| Variables and parameters | Meaning | Value |
| nh | level of host/dietary-derived nutrient reserves | - |
| ns | level of symbiont-derived nutrient reserves | - |
| s | symbiont population density | - |
| nh.max | maximum level of nh reserves | 20 |
| ns.max | maximum level of ns reserves | 5 |
| s.max | maximum density of symbiont population | 20 |
| nh.repro | minimum level of nh reserves required to reproduce | 8 |
| ns.repro | minimum level of ns reserves required to reproduce | 3 |
| s.repro | Minimum level of symbiont density for successful reproduction | 7 |
| nh.crit.pupae | minimum level of nh reserves to survive as a pupae | 4 |
| nh.crit.adult | minimum level of nh reserves to survive as an adult | 4 |
| nh.larva | Proportion of nh reserves spent on reproduction | 0.6 |
| ns.larva | Proportion of ns reserves spent on reproduction | 0.6 |
| mh.pupae | loss from nh reserves due to metabolic expenditure, per time step, for pupae | 1 |
| mh.adult | loss from nh reserves due to metabolic expenditure, per time step, for adults | 2 |
| ms.pupae | loss from ns reserves due to metabolic expenditure, per time step, for pupae | 2 |
| ms.adult | loss from ns reserves due to metabolic expenditure, per time step, for adults | 2 |
| ex.surv.pupae | state-independent probability of survival, for pupae | 1 |
| ex.surv.adult | state-independent probability of survival, for adults | 1 – 1/61 |
| t | time step | - |
| T | time horizon | 61 |
| n | number of resources for allocation per time step | 5 |
| m | slope of fitness as a function of nh.larva (linear) | 1 |
| i | cost of maintaining symbiont population (resources per symbiont state) | 0.02 |
| j | amount of additional symbiont density (symbiont density per resource invested) | 4 |
| k | amount of symbiont density removed (symbiont density per resource invested into regulation) | 4 |
| l | amount of resources produced by symbionts (resource per symbiont density) | 0.5 |
| d | index for decision made by host | - |

Model\_3a: **Dynamic Programming with for loops**

Functions:

nh.l = nh.larva\*(nh – mh) (constant proportion)

ns.l = ns.larva\*(ns – ms) (constant proportion)

Bh = m\*nh.l -m\*(nh.repro- mh)\* nh.larva (linear)

Bs = 0 if ns < ns.repro, 1 otherwise (step)

B = Bh\* Bs

in.survival = 0 if nh < nh.critical, 1 otherwise (step)

Pr(S) = in.survival\*ex.survival

maintenance = s\*i (linear)

s(t+1) = s(t) + number of resources invested\*j (investment, linear)

s(t+1) = s(t) – number of resources invested\*k (regulation, linear)

production = s\*l (linear)