Exercise 3

Payoff matrix

When using the payoff matrix, you use the following equations:

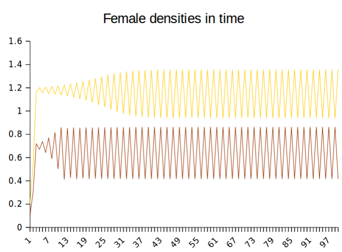
$$N_i(t+1) = N_i(t) + F_i . \frac{w_i(t)}{\bar{w}} . N_i(t) \left(1 - \frac{N_i}{K_i}\right)$$

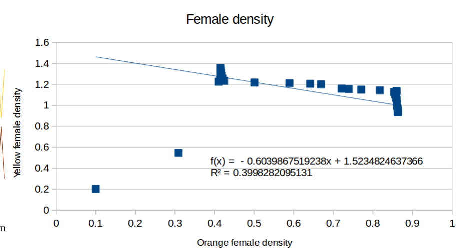
$$\left(\begin{array}{c} p_o(t) \\ p_y(t) \end{array} \right) = \left(\begin{array}{c} \frac{N_o(t)}{N_o(t)+N_y(t)} \\ \frac{N_y(t)}{N_o(t)+N_y(t)} \end{array} \right), \left(\begin{array}{c} w_o(t) \\ w_y(t) \end{array} \right) = \left(\begin{array}{cc} 1 & 1.61 \\ 1 & 1 \end{array} \right) \left(\begin{array}{c} p_o(t) \\ p_y(t) \end{array} \right)$$

,

Using the parameters, you get a two-cycle as shown below:

$$N(t=0) = \left(\begin{array}{c} N_o \\ N_y \end{array} \right) = \left(\begin{array}{c} 0.1 \\ 0.2 \end{array} \right), \left(\begin{array}{c} F_o \\ F_y \end{array} \right) = \left(\begin{array}{c} 2.2 \\ 2.2 \end{array} \right), \left(\begin{array}{c} K_o \\ K_y \end{array} \right) = \left(\begin{array}{c} 0.7 \\ 1.18 \end{array} \right)$$

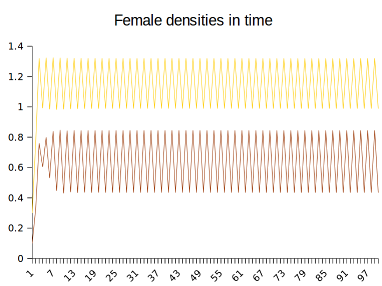


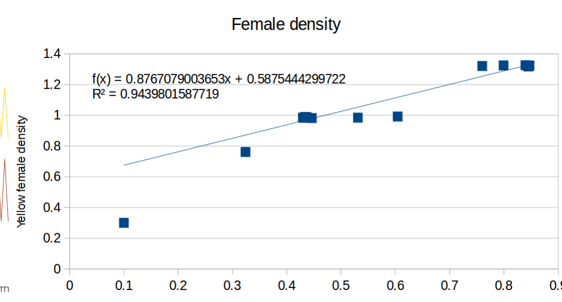


In the figures above, a high density of one species occurs simultaneously with a low density of the other.

When using the initial densities below, this evasion game changes to a co-ordination game, in which both morphs are both either at high or both at low densities:

$$N(t=0) = \left(\begin{array}{c} N_o \\ N_y \end{array} \right) = \left(\begin{array}{c} 0.1 \\ 0.3 \end{array} \right)$$





Fitness functions

When using the fitness formula's below table 1, you use the following equations:

$$N_i(t+1) = N_i(t) + F_i.\frac{w_i(t)}{\bar{w}}.N_i(t)\left(1 - \frac{N_i}{K_i}\right)$$

$$\begin{pmatrix} p_o(t) \\ p_y(t) \end{pmatrix} = \begin{pmatrix} \frac{N_o(t)}{\sum N_i(t)} \\ \frac{N_y(t)}{\sum N_i(t)} \end{pmatrix}$$

This is my own magic:

$$\begin{pmatrix} N_{oo}(t) & 2.N_{oy}(t) \\ 2.N_{oy}(t) & N_{yy}(t) \end{pmatrix} = \begin{pmatrix} p_o(t)p_o(t)\sum N_i(t) & 2.p_o(t)p_y(t)\sum N_i(t) \\ 2.p_o(t)p_y(t)\sum N_i(t) & p_y(t)p_y(t)\sum N_i(t) \end{pmatrix}$$

$$\begin{pmatrix} w_o(t) \\ w_y(t) \end{pmatrix} = \begin{pmatrix} w_{o1}(t) + w_{o2-5}(t) \\ w_{y1}(t) + w_{y2-5}(t) \end{pmatrix} = \begin{pmatrix} fill.in.formula.here \\ fill.in.formula.here \end{pmatrix}$$

Using the parameters, you get a two-cycle as shown below:

$$N(t=0) = \begin{pmatrix} N_o \\ N_y \end{pmatrix} = \begin{pmatrix} 0.1 \\ 0.2 \end{pmatrix}, \begin{pmatrix} F_o \\ F_y \end{pmatrix} = \begin{pmatrix} 2.2 \\ 2.2 \end{pmatrix}, \begin{pmatrix} K_o \\ K_y \end{pmatrix} = \begin{pmatrix} 0.7 \\ 1.18 \end{pmatrix}$$