Exercise 2: Consumer-Resource model with Type I functional response

We are now moving on to a two-dimensional system describing consumer (C) and resource (R) dynamics over time, using two functions we will refer to as fR and fC:

$$fR = \frac{dR}{dt} = rR\left(1 - \frac{R}{K}\right) - aCR$$

$$fC = \frac{dC}{dt} = eaCR - mC$$

where r is the resource population growth rate, K is resource carrying capacity, a is consumer attack rate, e is energy conversion efficiency and m is consumer mortality.

To do by hand (symbolically):
1. Solve for all equilibria and isoclines
2. Plot the isoclines in state space
    ⇒ draw trajectories directly on the clines
    ⇒ fill out the vector field throughout the state space
3. Take the partial derivatives of fR and fC to calculate the Jacobian matrix
    ⇒ substitute each equilibrium in for R and C
4. Calculate the eigenvalues for each equilibrium using the characteristic equation

* Remember to refer to the "Getting Started" notes if you have any questions about these steps.

To do using code:
Once you have done this by hand, you can confirm your answers using code.
1. Take the notebook you already have (the L-V competition model we've been working with), in whatever coding language you'd like, and convert it to this C-R model.
    ⇒ This should be as simple as changing the functions, but you will need to alter the parameter list and may want to re-name the state variables.
2. Confirm the symbolic solutions you calculated by hand
3. To plot the isoclines you will need to define a parameter set, but this will be a good opportunity to become familiar with the "Manipulate" function

Next week we will go through the hand-written answers and answer anyone's coding questions.