

BauchModel_DefaultParamsHighMovement

Sophie Wulfing

12 July, 2023, 15:23

Table 1: Parameter values used in this analysis

Parameter	Population_1	Population_2	Def
r	0.16	0.16	Fish net growth
s	0.8	0.8	Supply and demand
h	0.25	0.25	Harvesting efficiency
k	0.17	0.17	Social learning rate
w	1.44	1.44	Conservation cost
c	0.5	0.5	Rarity valuation
d	0.3	0.3	Social norm strength (within pop)
i	0	0	Fish immigration (from opposite patch)
rho	0	0	Social norm strength (opposite pop)

Table 2: Starting values used in this analysis

Parameter	Population_1	Population_2
F	0.406	0.406
X	0.240	0.240

SCENARIO: OSCILLATIONS

Function:

$$\frac{dP_1}{dt} = r_1 P_1 (1 - P_1) - \frac{h_1 * P_1 (1 - X_1)}{P_1 + s_1} - e_1 P_1 + i_1 P_2$$

$$\frac{dP_2}{dt} = r_2 P_2 (1 - P_2) - \frac{h_2 * P_2 (1 - X_2)}{P_2 + s_2} - e_2 P_2 + i_2 P_1$$

$$\frac{dX_1}{dt} = k_1 X_1 (1 - X_1) \left[\frac{1}{P_1 + c_1} - w_1 + d_1 (2X_1 - 1) + prop_1 (2X_2 - 1) \right]$$

$$\frac{dX_2}{dt} = k_2 X_2 (1 - X_2) \left[\frac{1}{P_2 + c_2} - w_2 + d_2 (2X_2 - 1) + prop_2 (2X_1 - 1) \right]$$

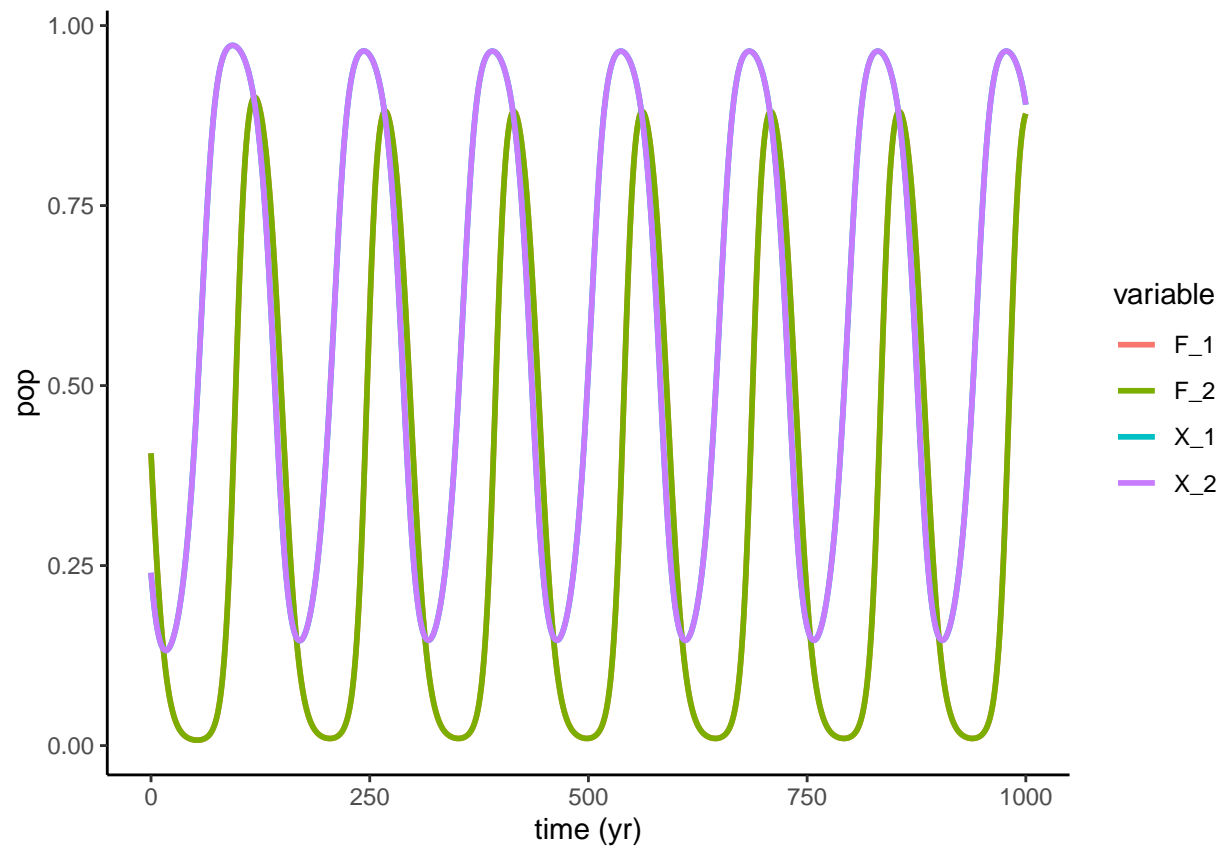


Figure 1: New Model with default paramters

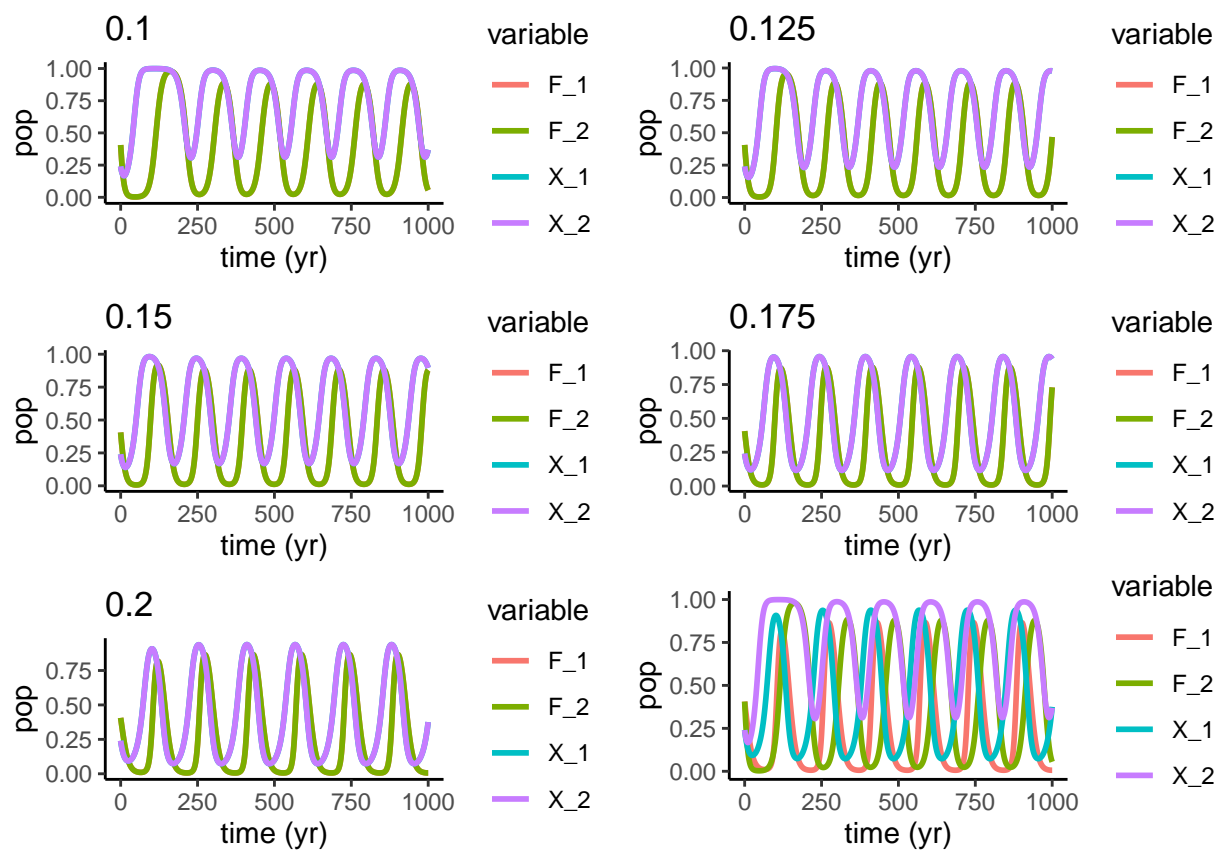


Figure 2: r - Net growth/fecundity, range 0.1 to .2

```

## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 1.24273e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 1.24273e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 1.0294e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 1.0294e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 1.0294e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 8.22899e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 8.22899e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 6.81638e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 6.81638e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 143.431, R2 = 6.81638e-15
##
## DLSODA- Above warning has been issued I1 times.
##      It will not be issued again for this problem.
## In above message, I1 = 10
##

```

```

## DLSODA- At current T (=R1), MXSTEP (=I1) steps
##      taken on this call before reaching TOUT
## In above message, I1 = 5000
##
## In above message, R1 = 143.431
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 4.95453e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 4.95453e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 4.10403e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 4.10403e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 4.10403e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 3.28075e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 3.28075e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 2.71757e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 652.5, R2 = 2.71757e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine,  $T + H = T$  on the next step
##      (H = step size). Solver will continue anyway.

```

```

## In above message, R1 = 652.5, R2 = 2.71757e-14
##
## DLSODA- Above warning has been issued I1 times.
## It will not be issued again for this problem.
## In above message, I1 = 10
##
## DLSODA- At current T (=R1), MXSTEP (=I1) steps
## taken on this call before reaching TOUT
## In above message, I1 = 5000
##
## In above message, R1 = 652.5
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 1.25179e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 1.25179e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 1.0369e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 1.0369e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 1.0369e-14
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 8.28898e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 8.28898e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step
## (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 6.86608e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
## such that in the machine,  $T + H = T$  on the next step

```

```

##      (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 6.86608e-15
##
## DLSODA- Warning..Internal T (=R1) and H (=R2) are
##      such that in the machine, T + H = T on the next step
##      (H = step size). Solver will continue anyway.
## In above message, R1 = 160.643, R2 = 6.86608e-15
##
## DLSODA- Above warning has been issued I1 times.
##      It will not be issued again for this problem.
## In above message, I1 = 10
##
## DLSODA- At current T (=R1), MXSTEP (=I1) steps
##      taken on this call before reaching TOUT
## In above message, I1 = 5000
##
## In above message, R1 = 160.643
##

```

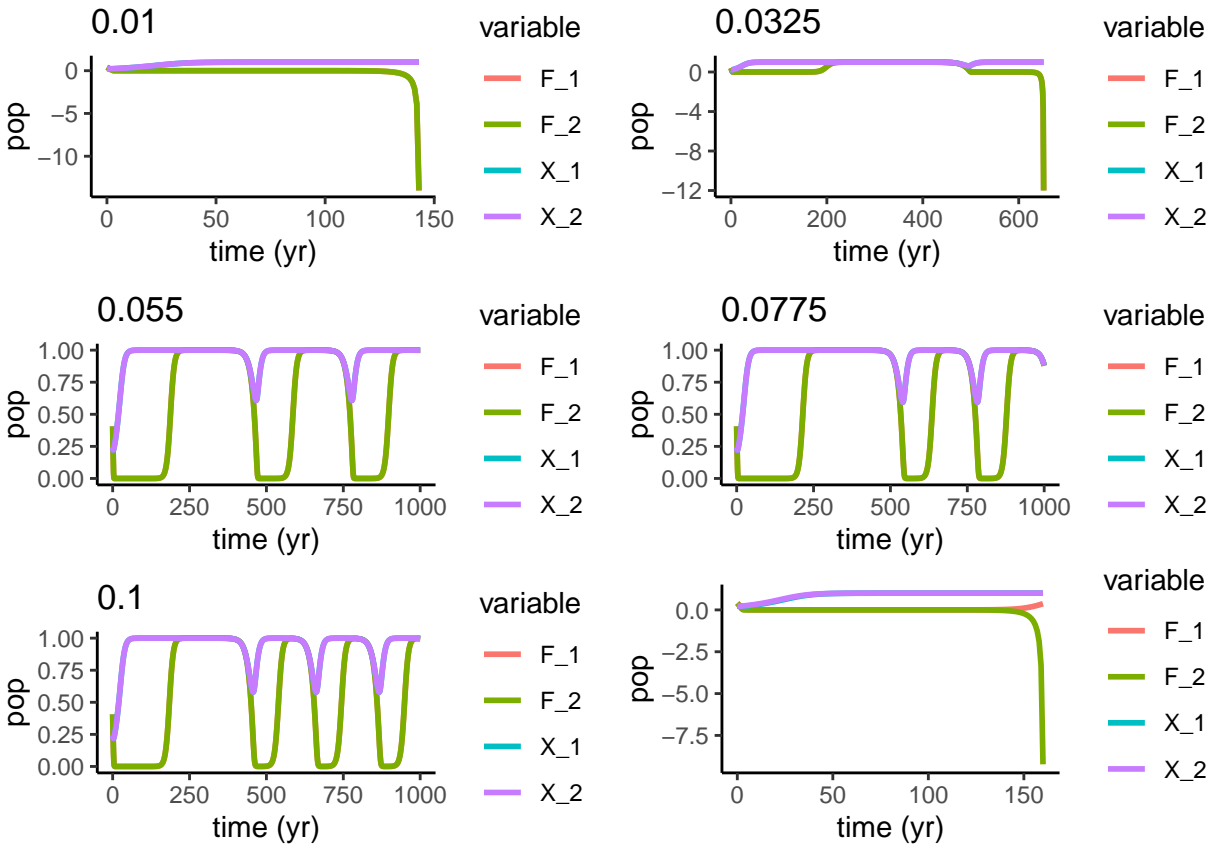


Figure 3: s - supply and demand, range 0.1 to 1

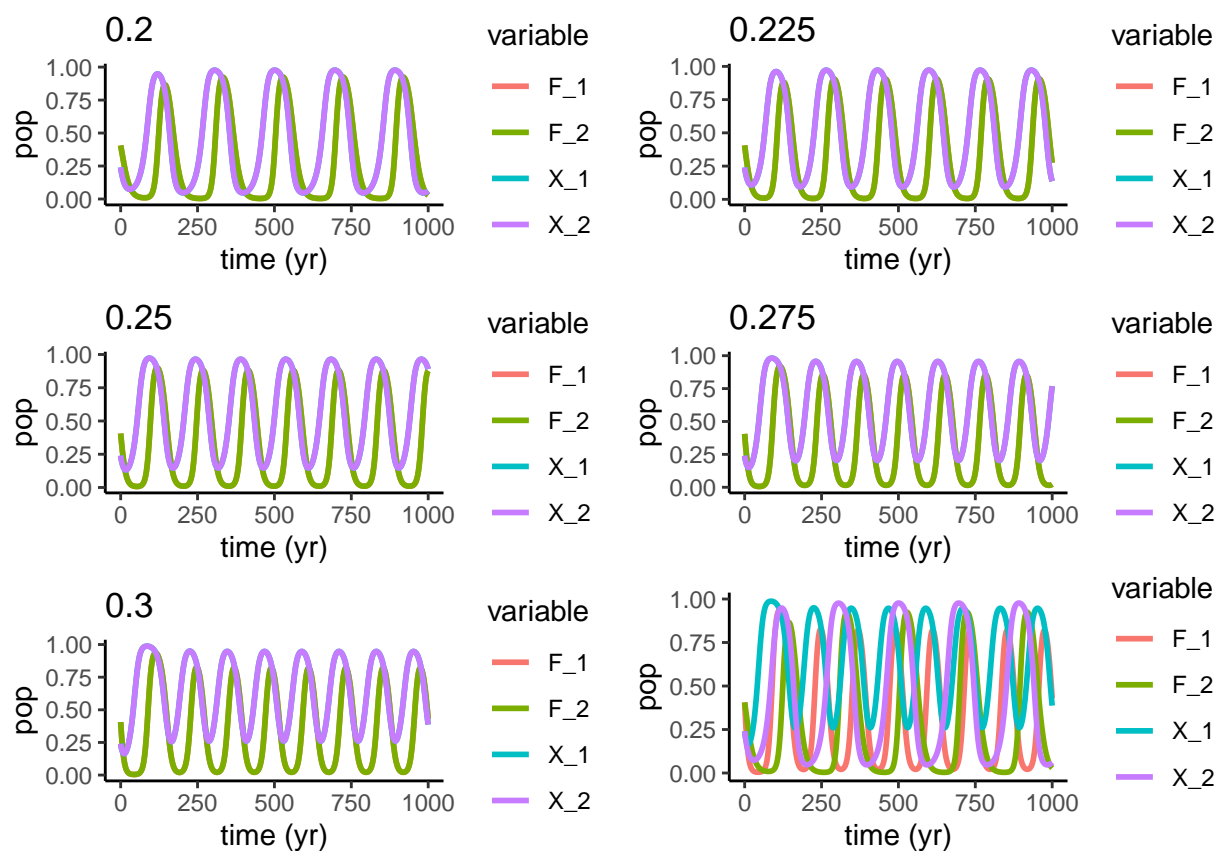


Figure 4: h - Harvesting efficiency, range 0 to 0.1. Note, default is .075

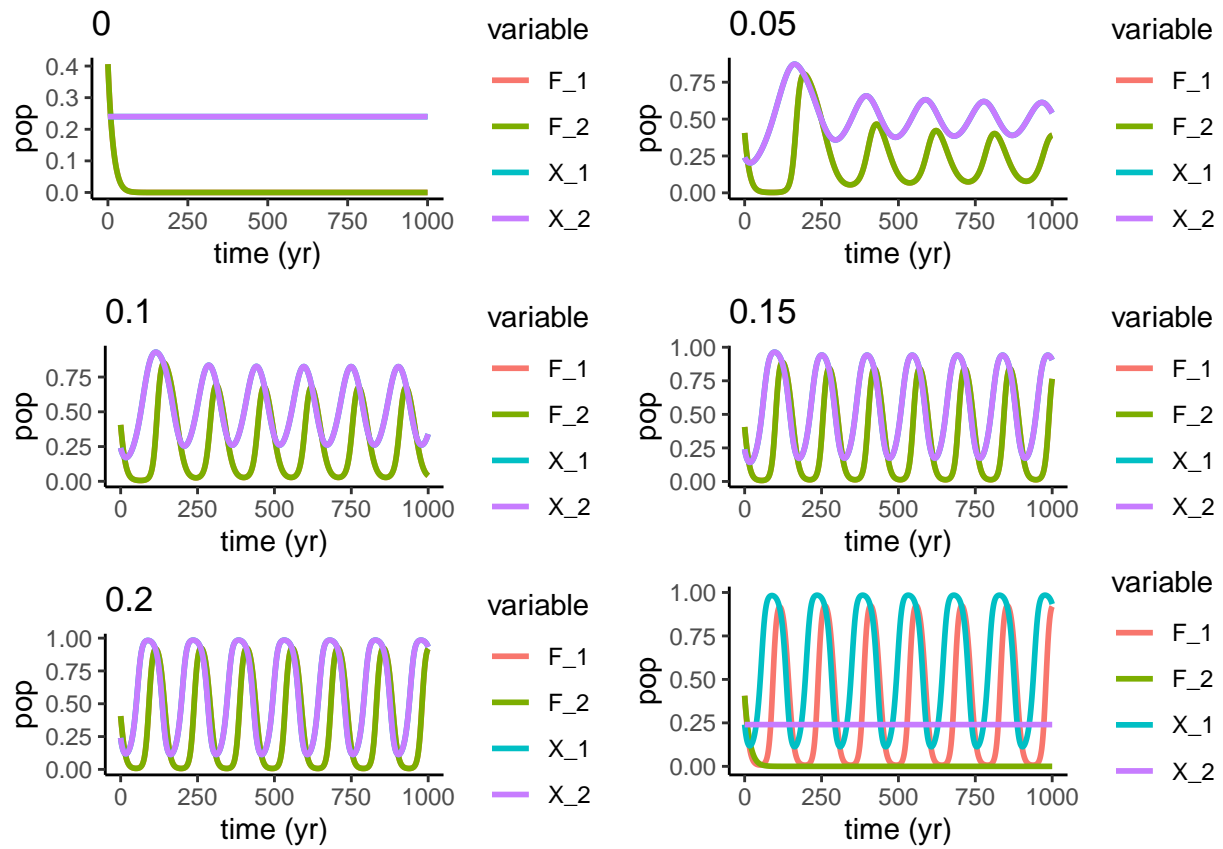


Figure 5: K - Social learning rate 0 to 1

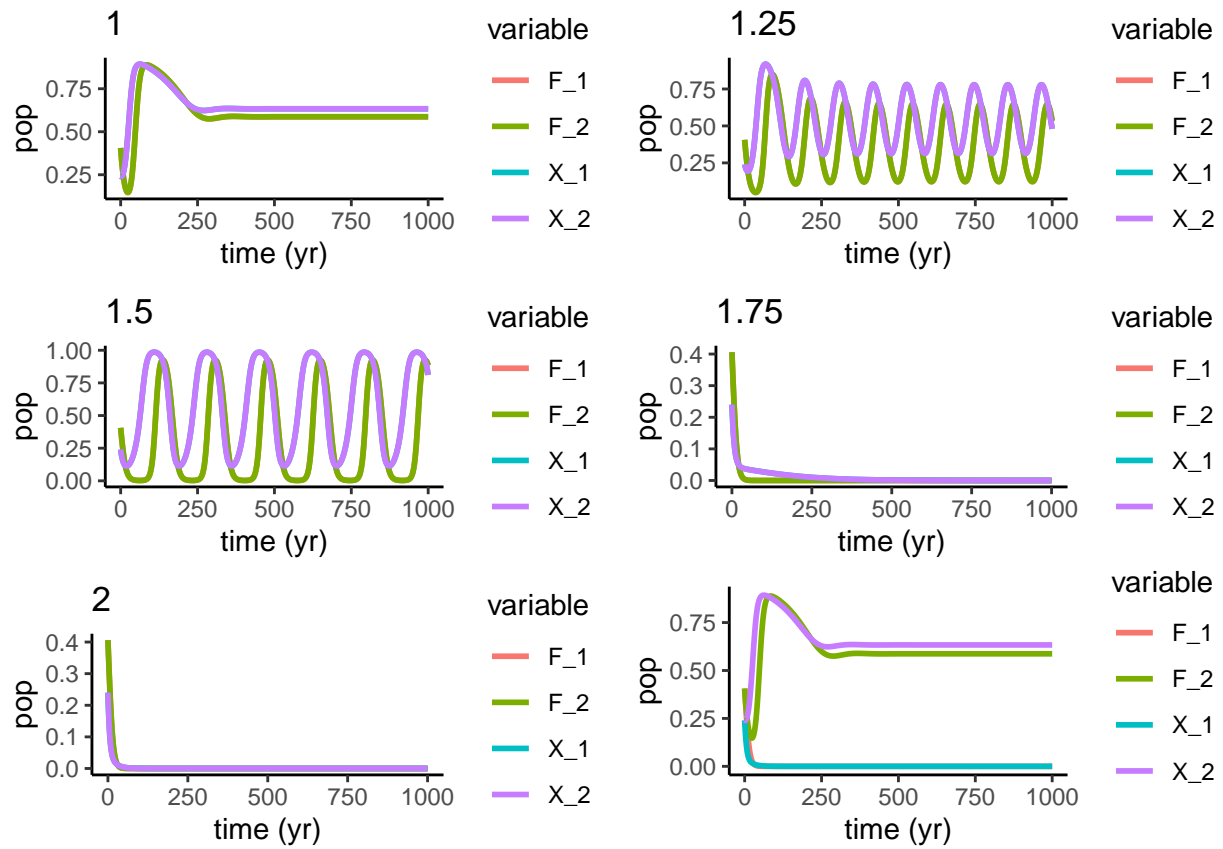


Figure 6: w - conservation costs

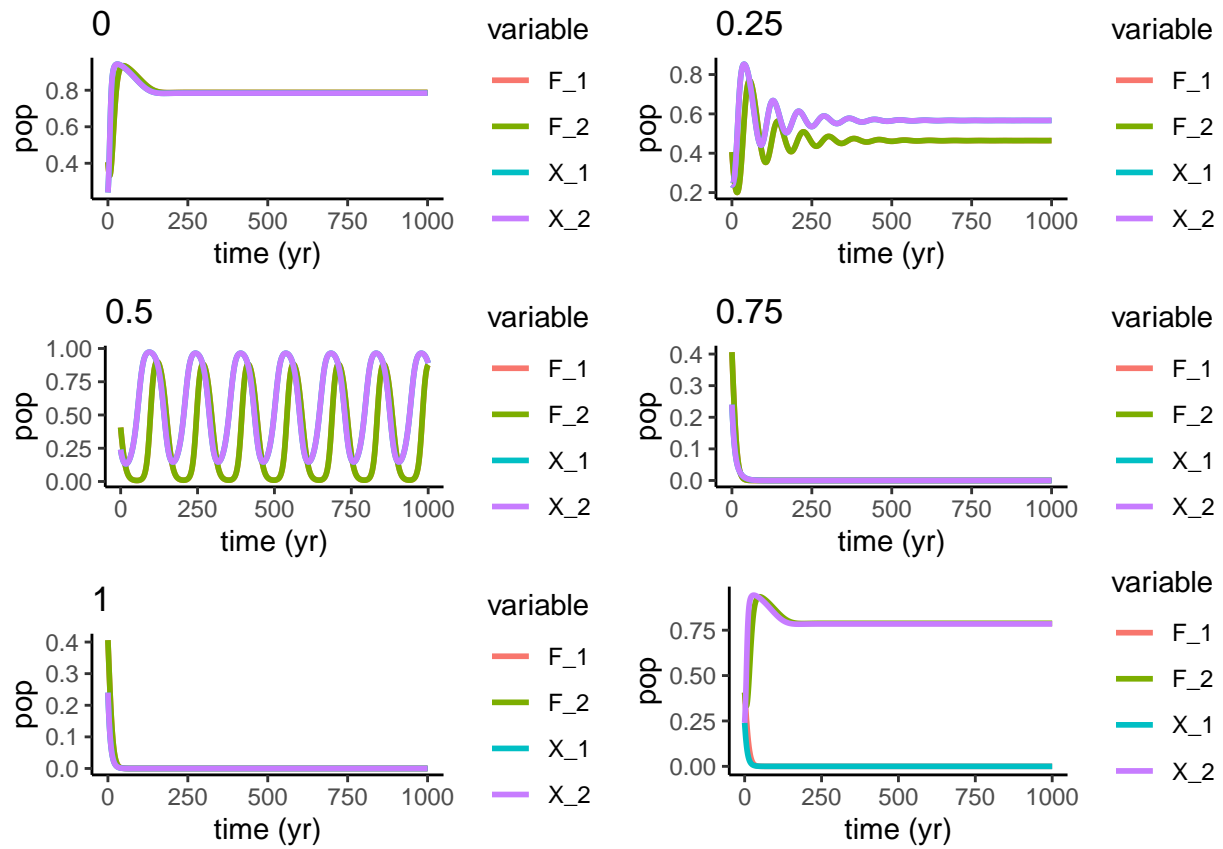


Figure 7: c - rarity valuation param

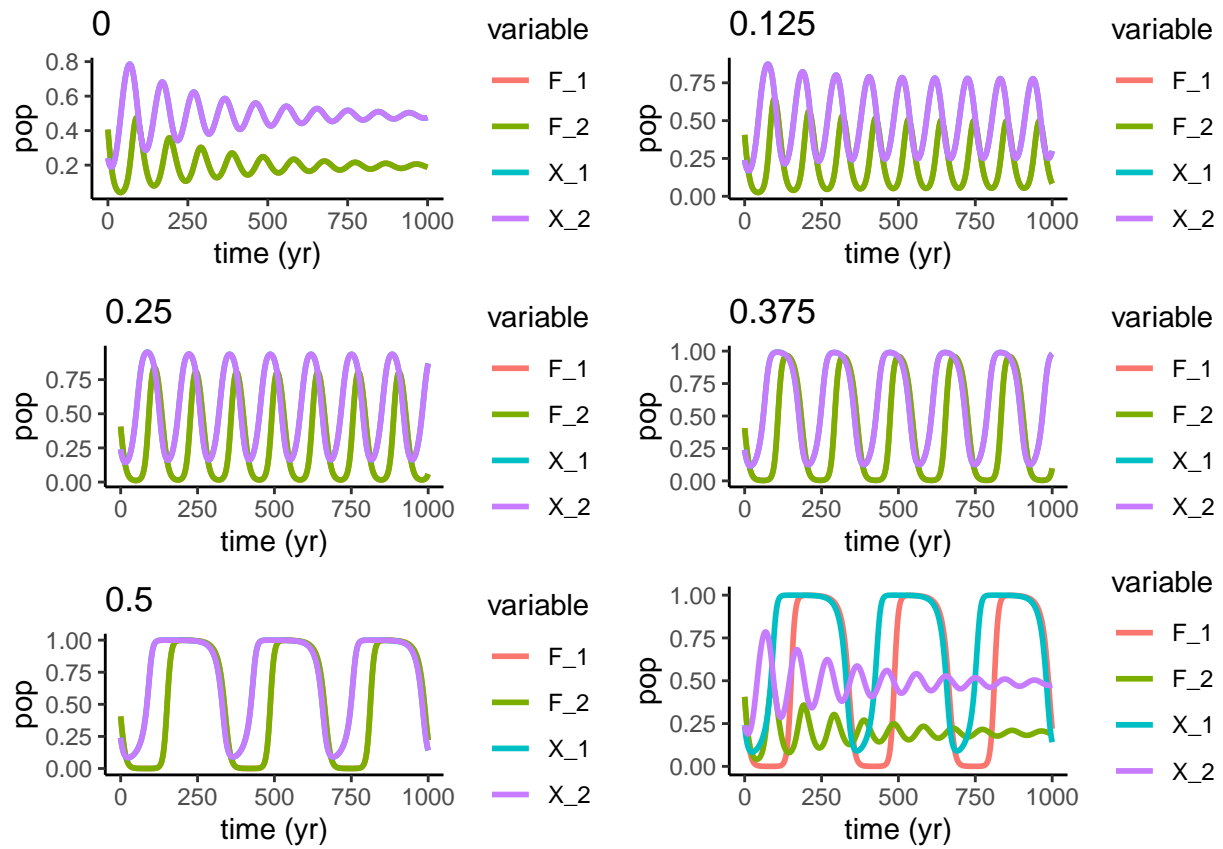


Figure 8: d - social norm strength

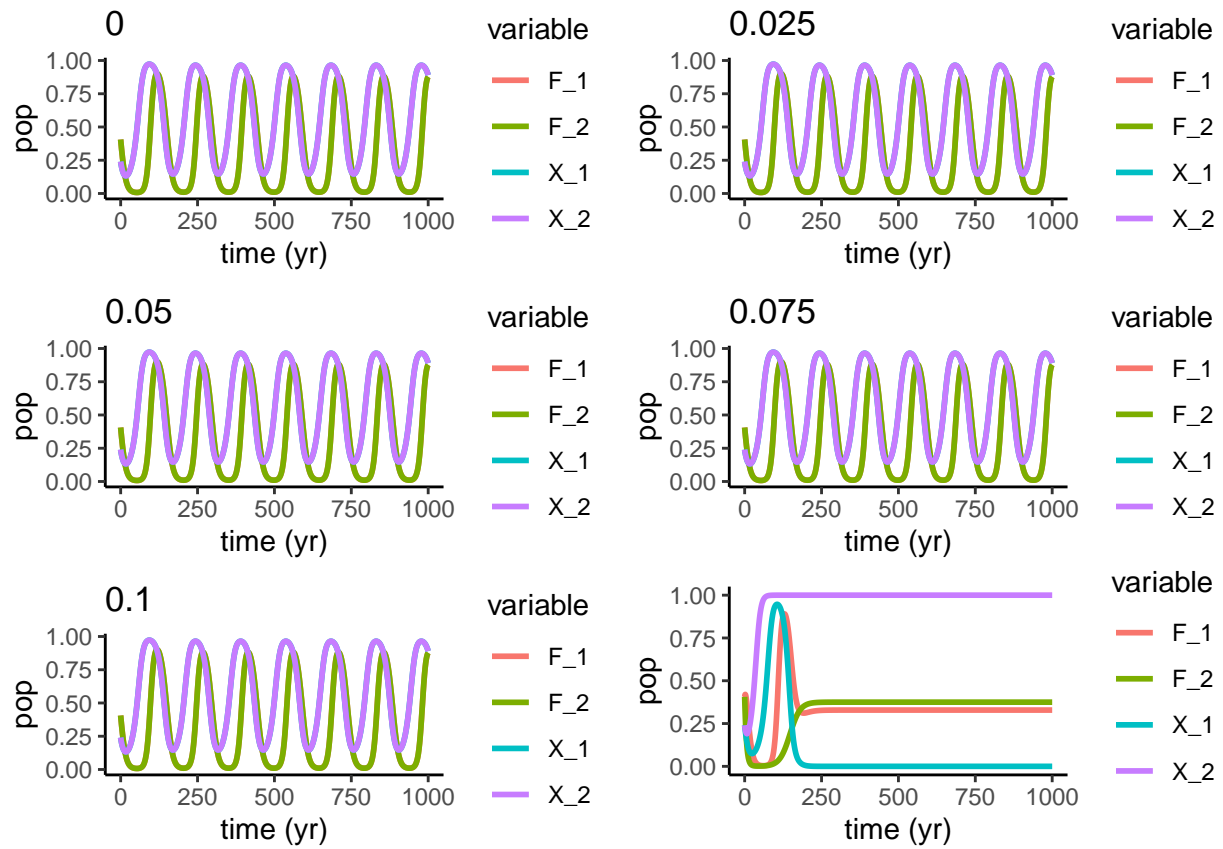


Figure 9: i - fish immigration

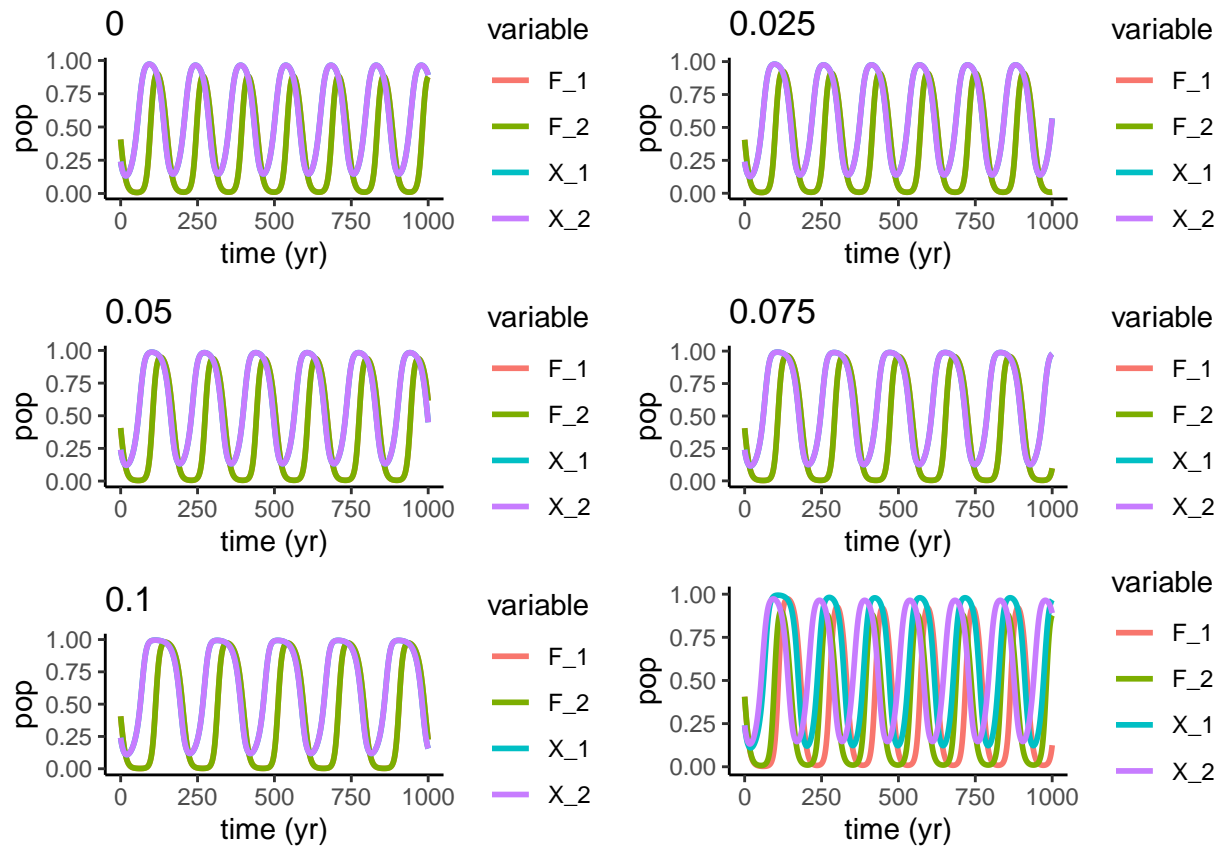


Figure 10: ρ - Population influence on the other

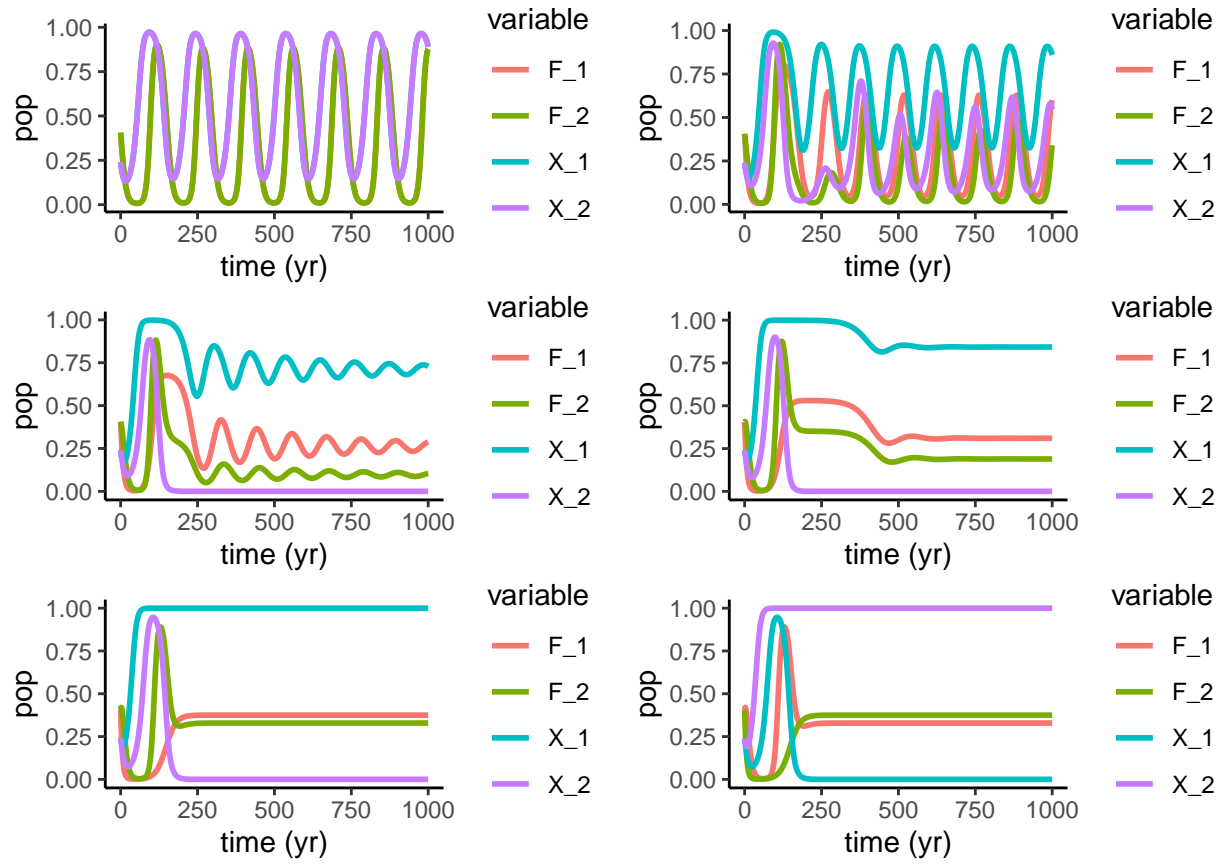


Figure 11: increasing only the i_2 parameter

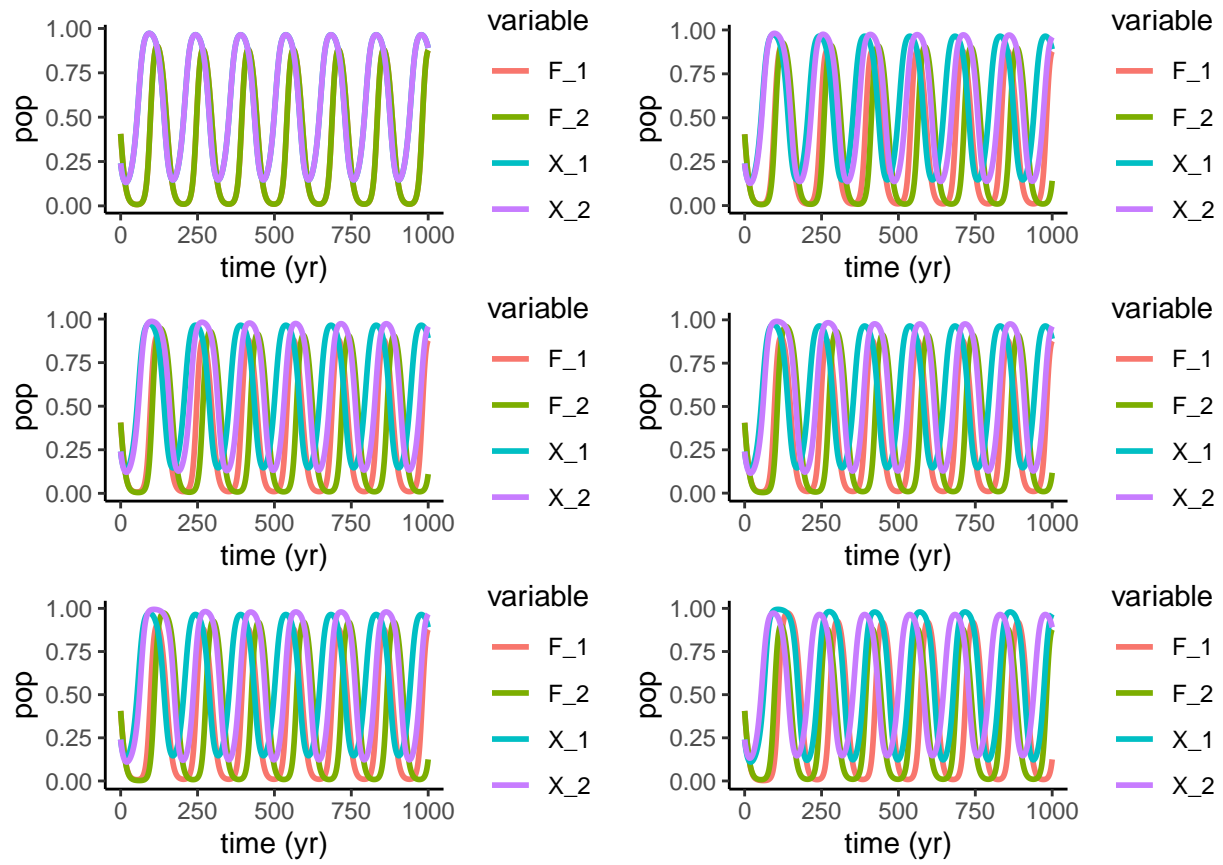


Figure 12: increasing only the ρ_2 parameter