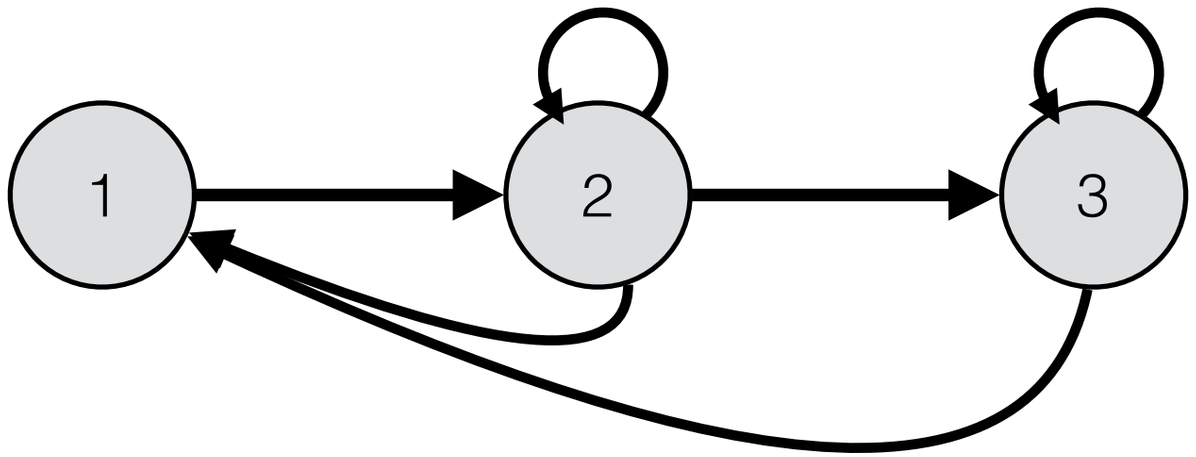
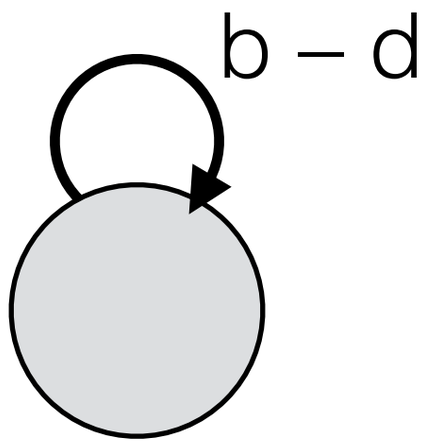
No structure = averaging





- A single state variable—“stage”—captures all important variation in individual demographic rates

- Demographic rates are constant

∴ Populations converge to an equilibrium growth rate (λ) and stage structure (w)

$$\begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix}$$

1. Constant

Variable

Internally-generated

2. Frequency-dependent

Density-dependent

3. Externally-generated

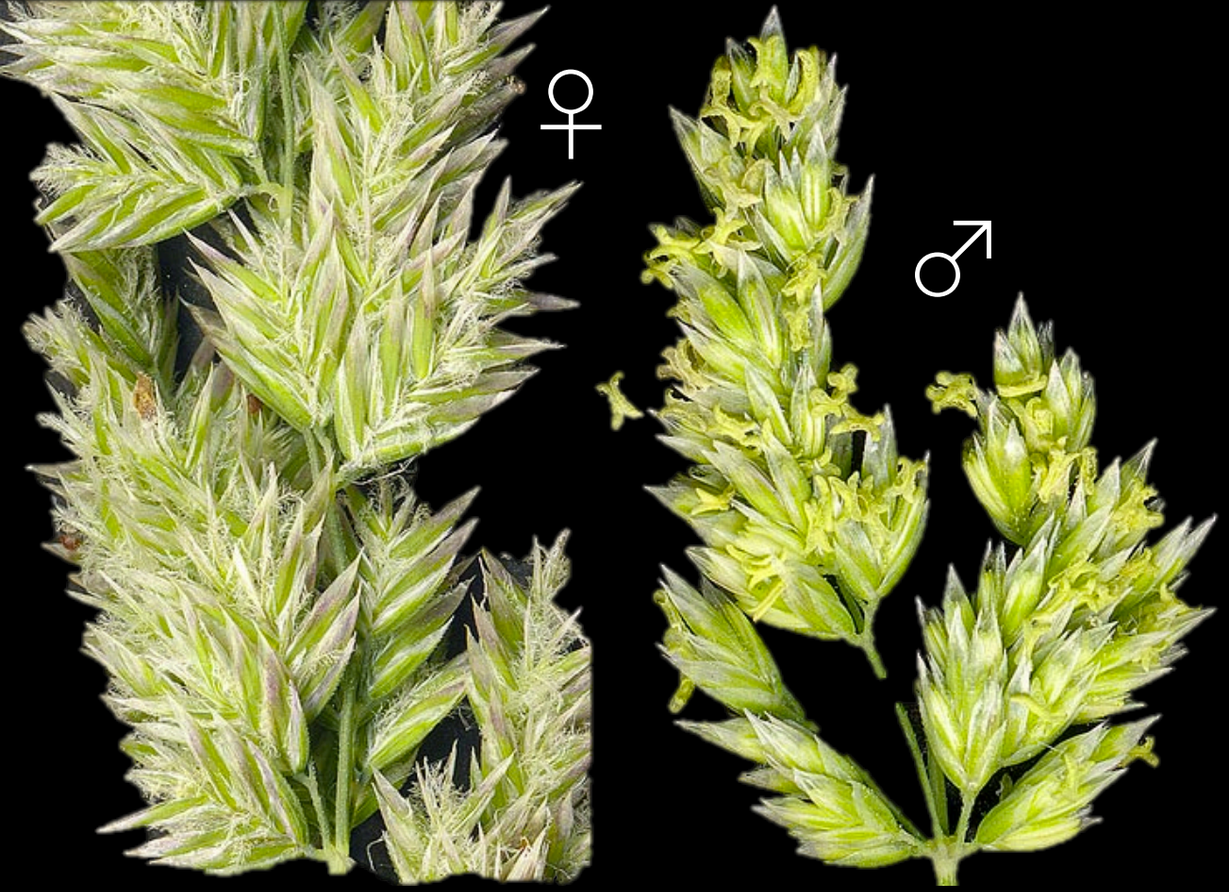
Both

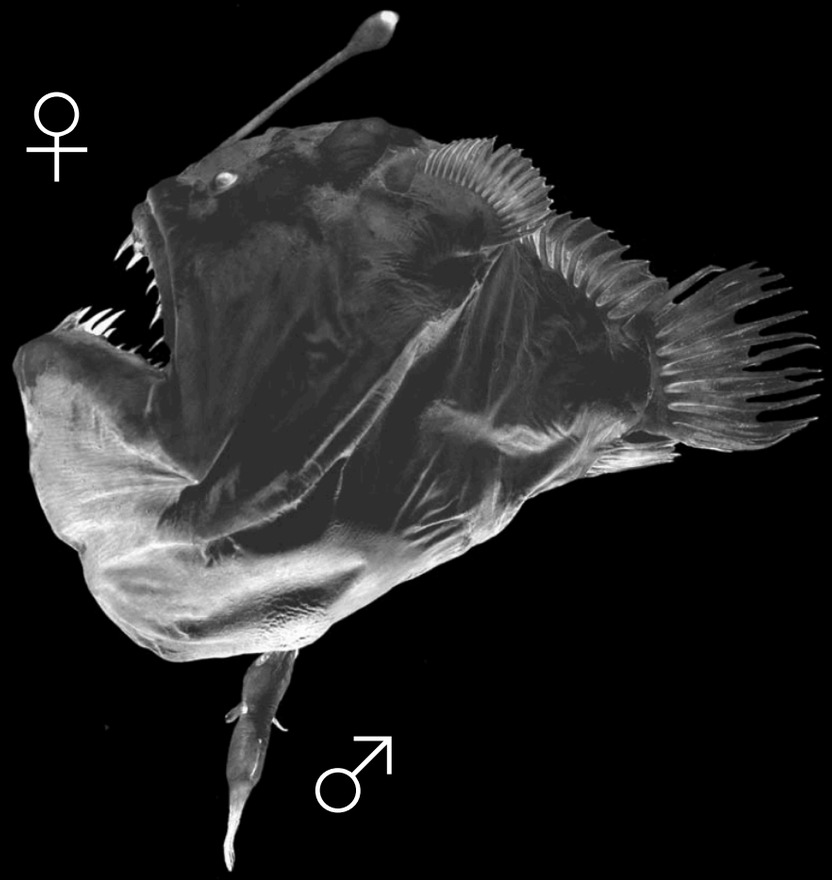
Deterministic

Stochastic

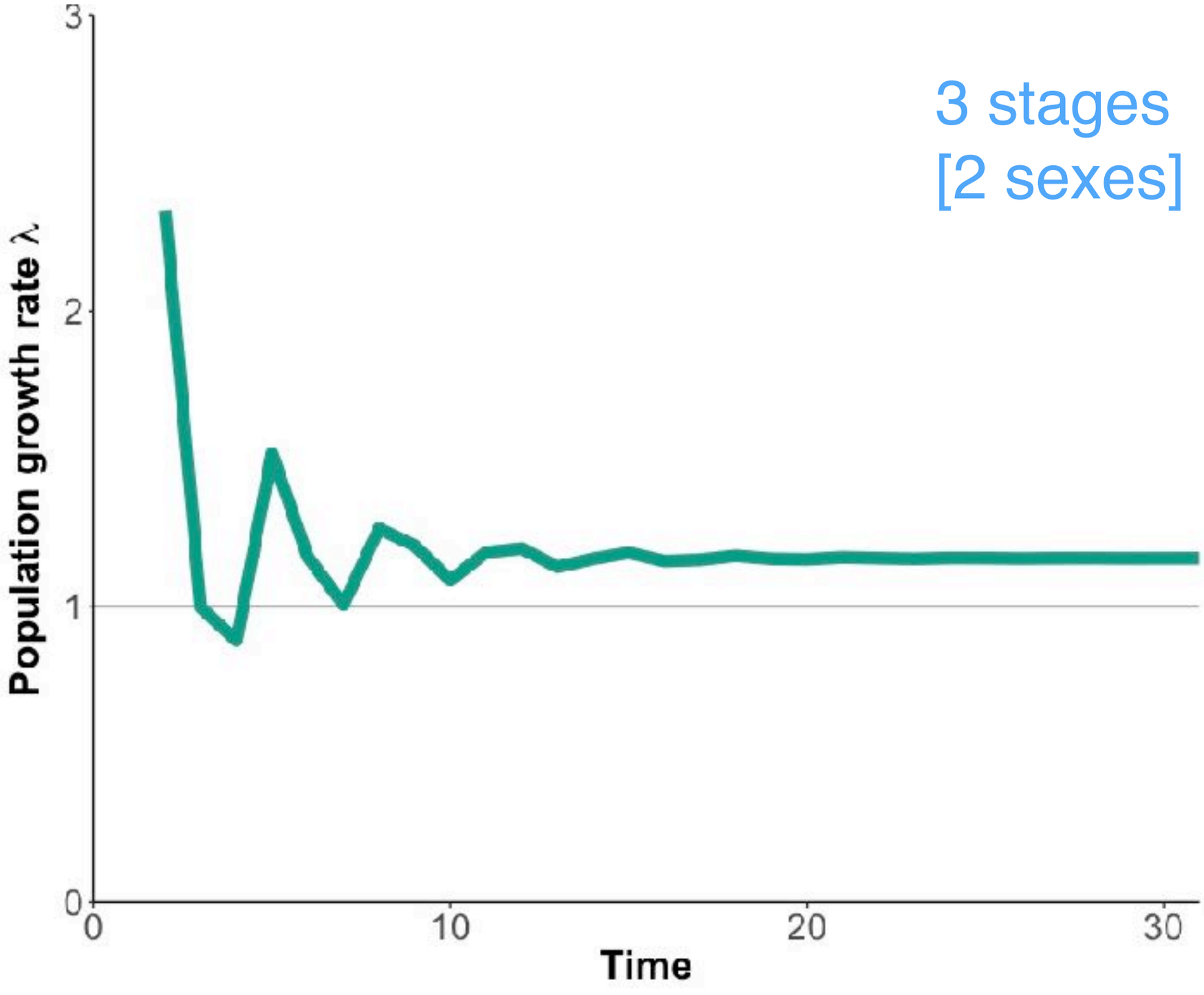
Periodic

Aperiodic



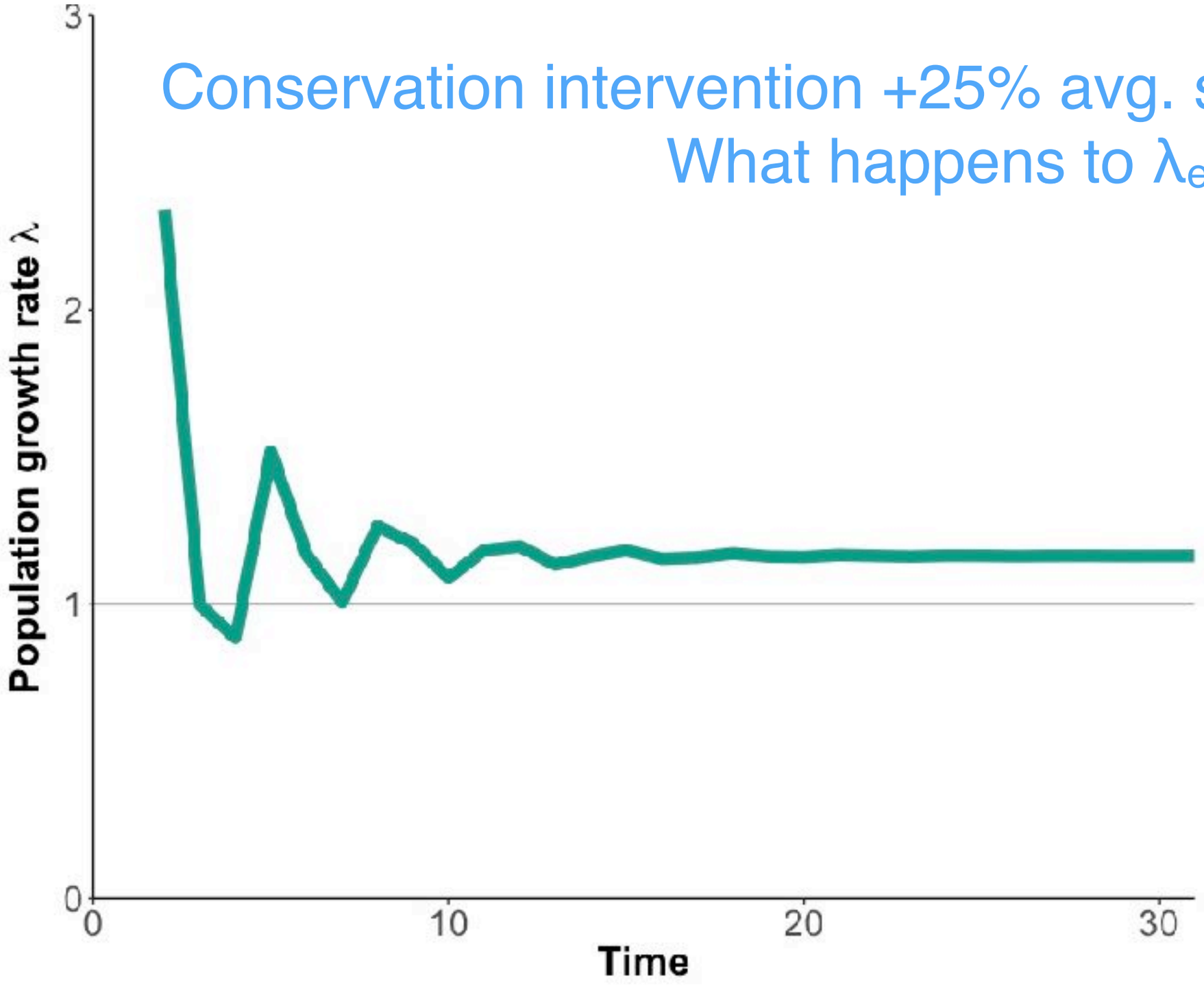


Two-sex population dynamics



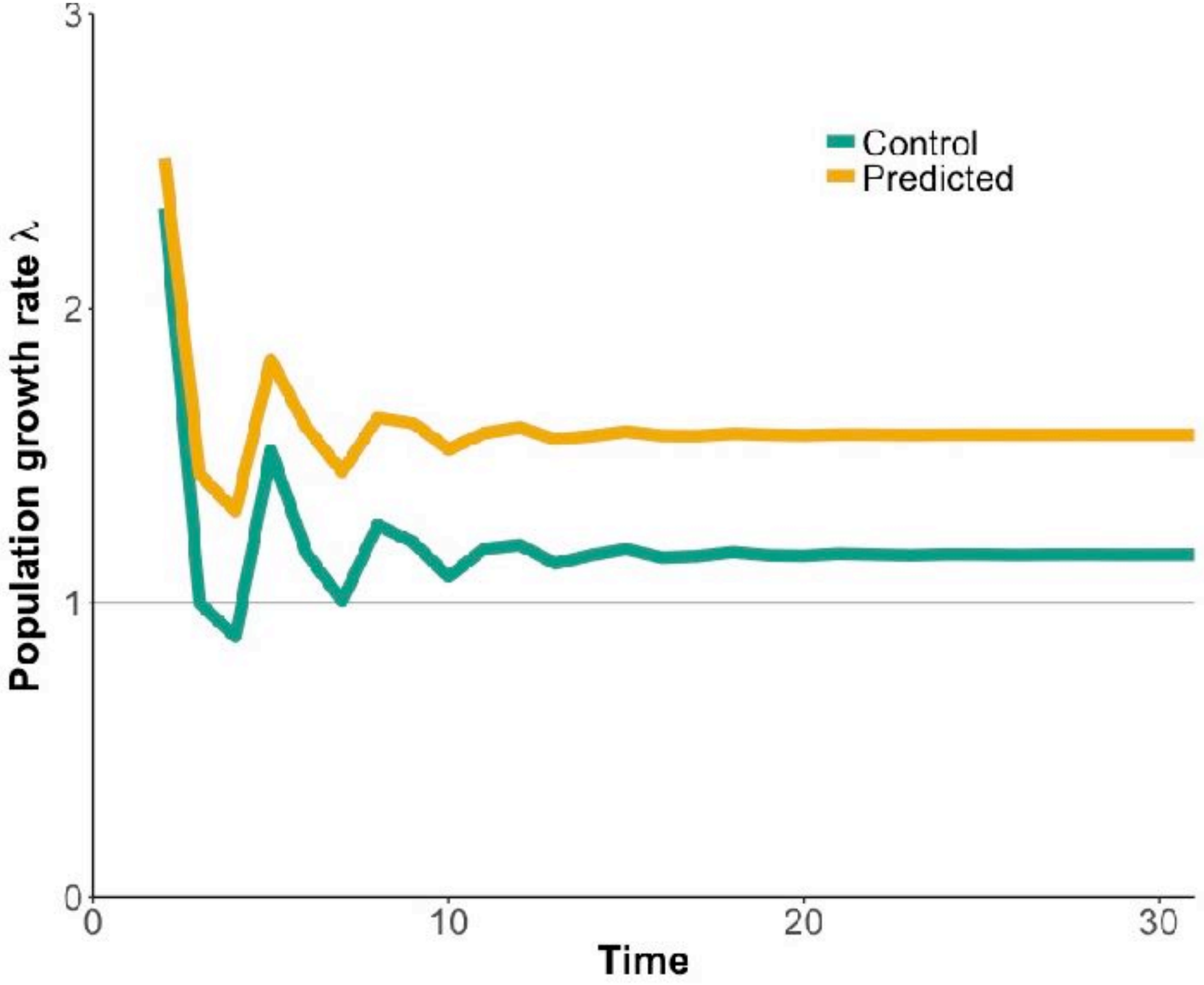
3 stages
[2 sexes]

Two-sex population dynamics

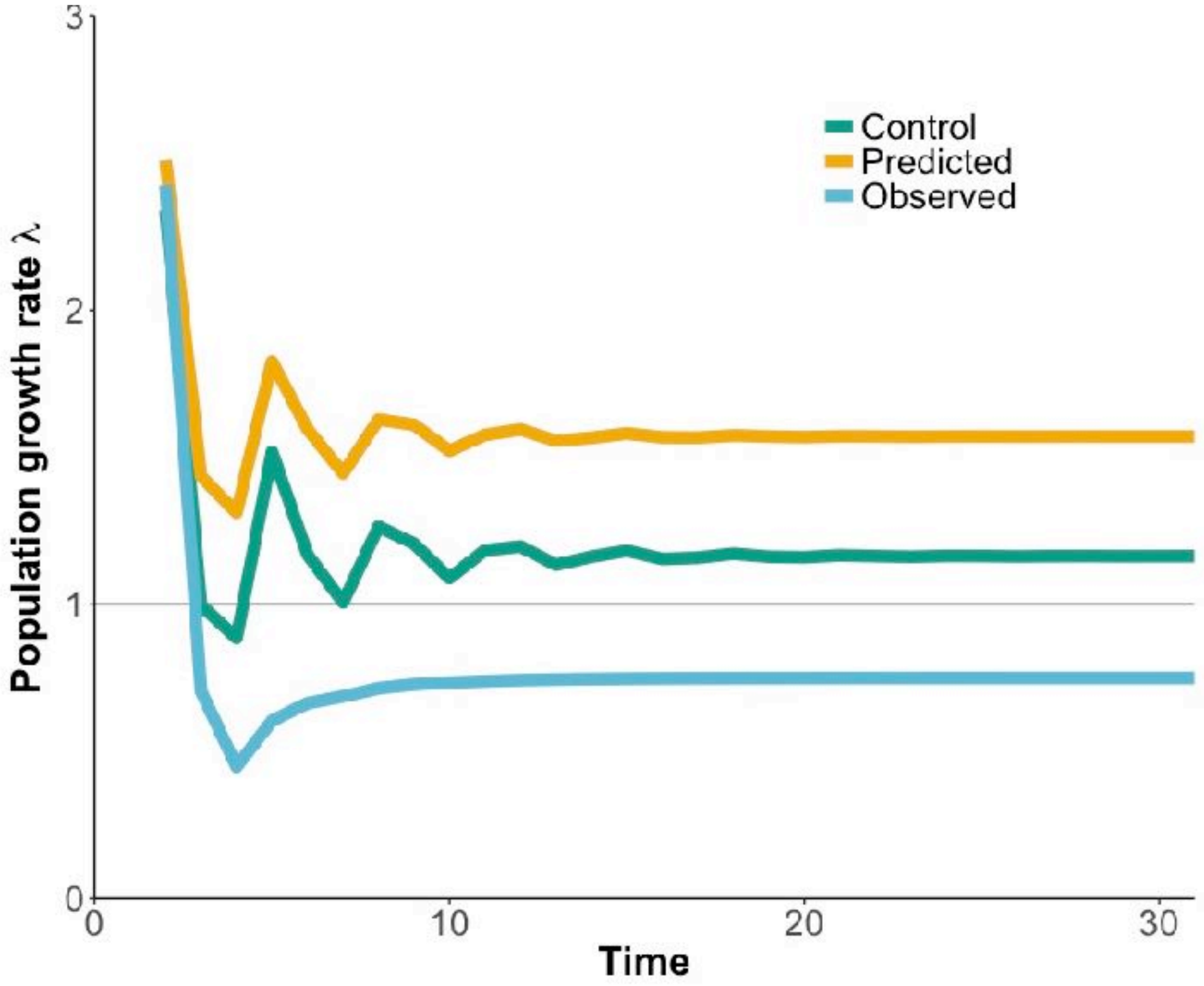


Conservation intervention +25% avg. survival.
What happens to $\lambda_{equilibrium}$?

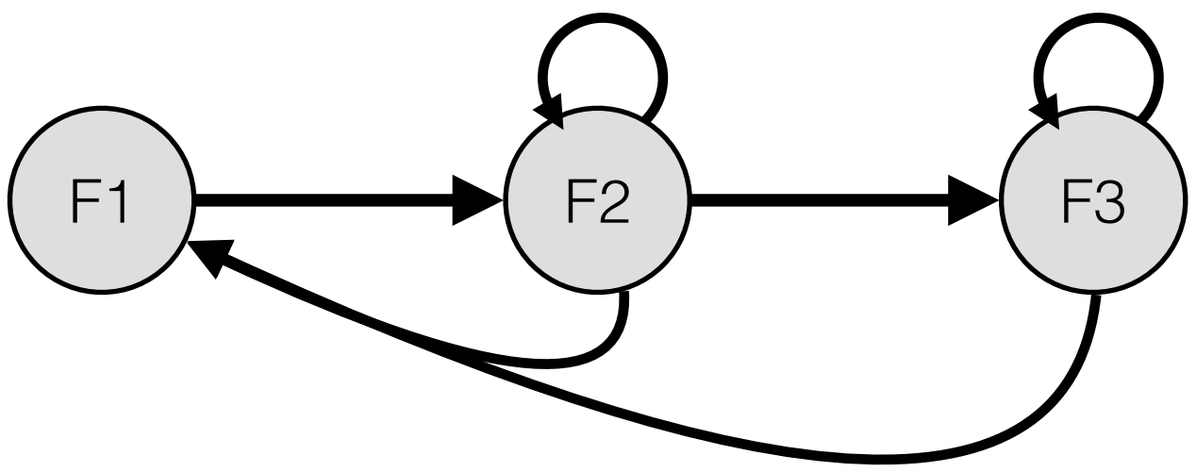
Two-sex population dynamics



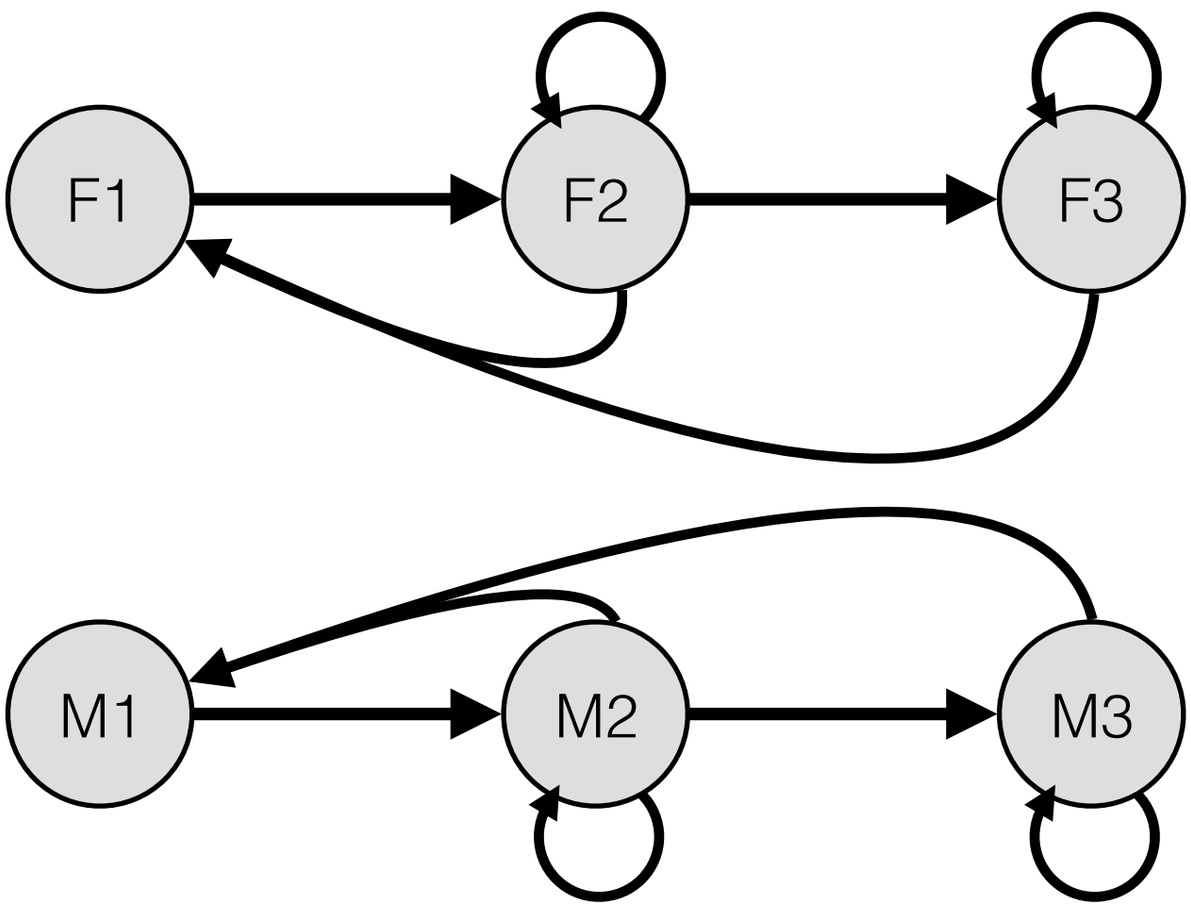
Two-sex population dynamics



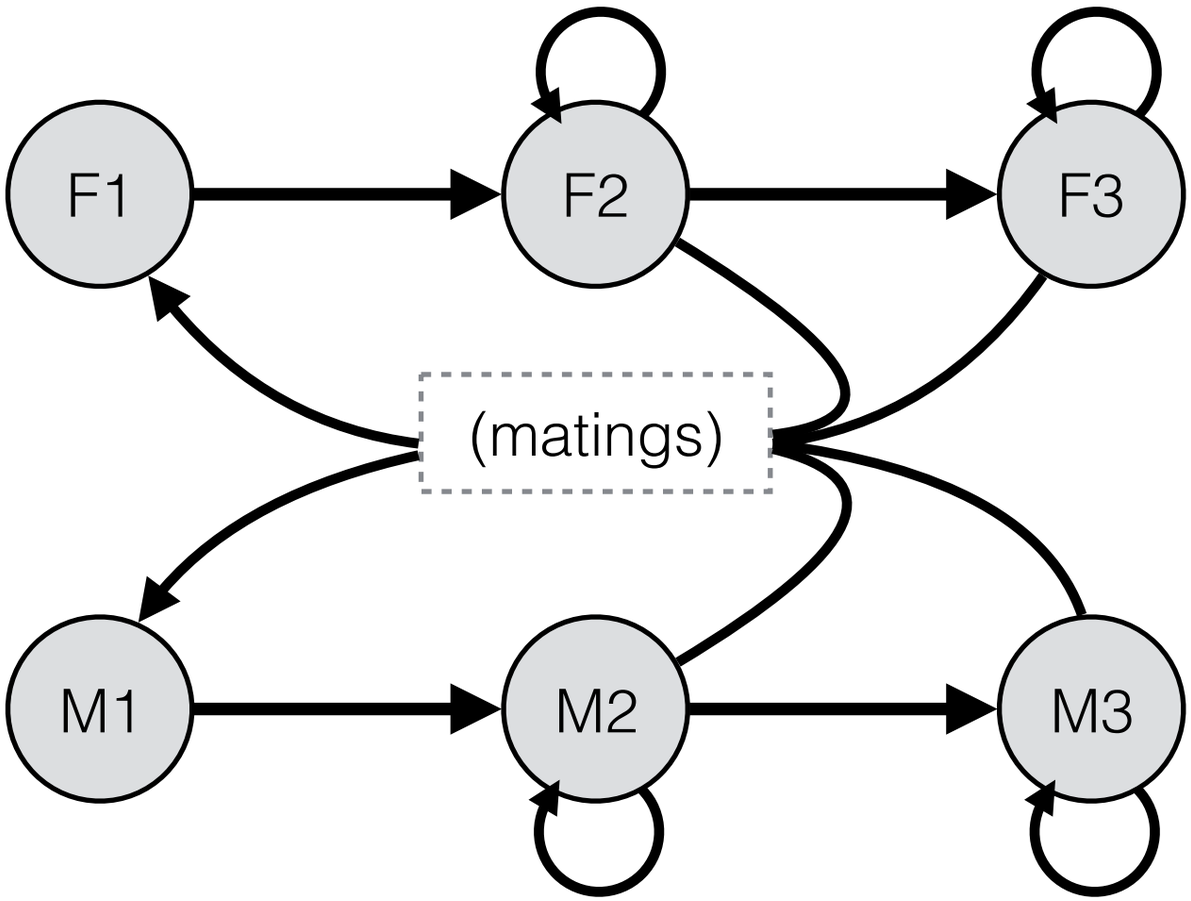
Modeling sex structure



Modeling sex structure



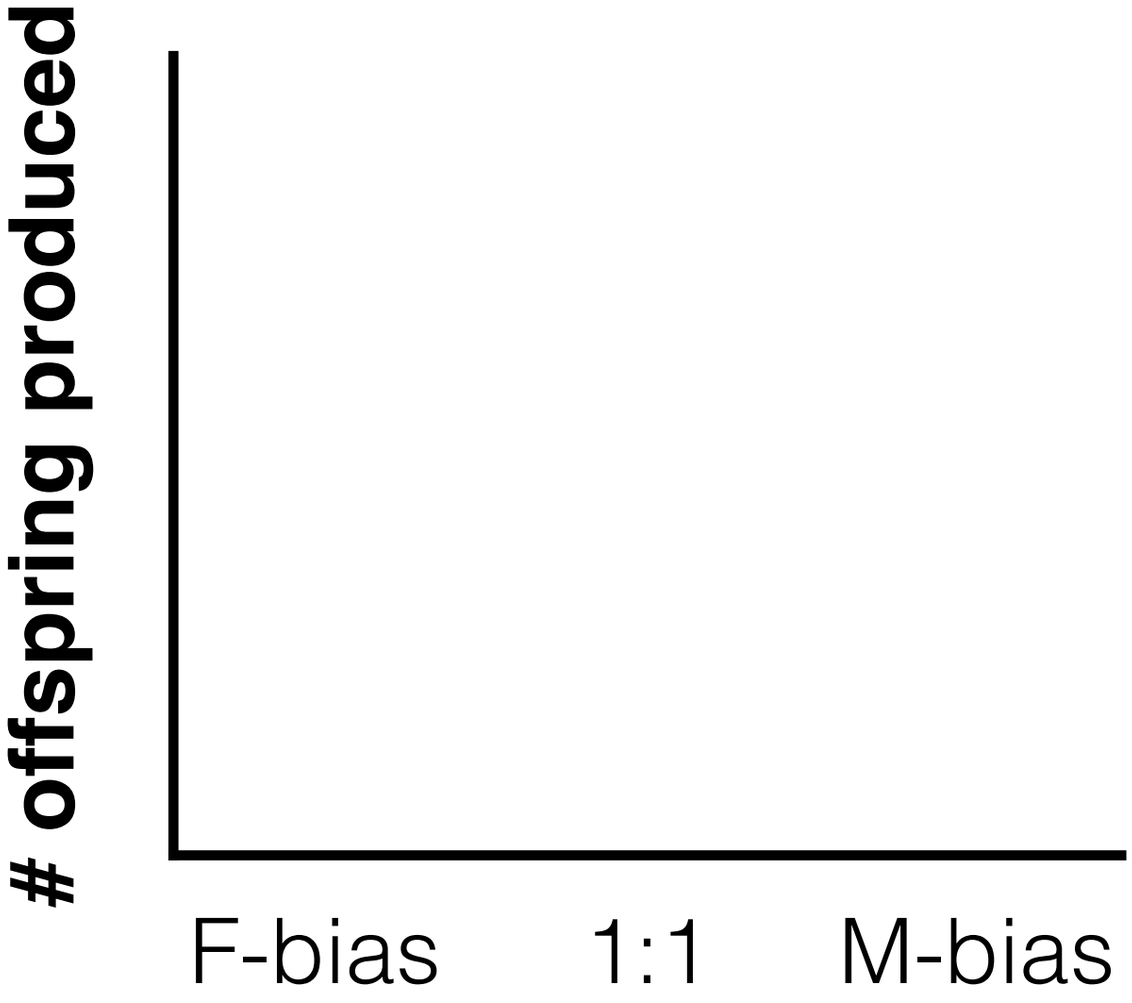
Modeling sex structure

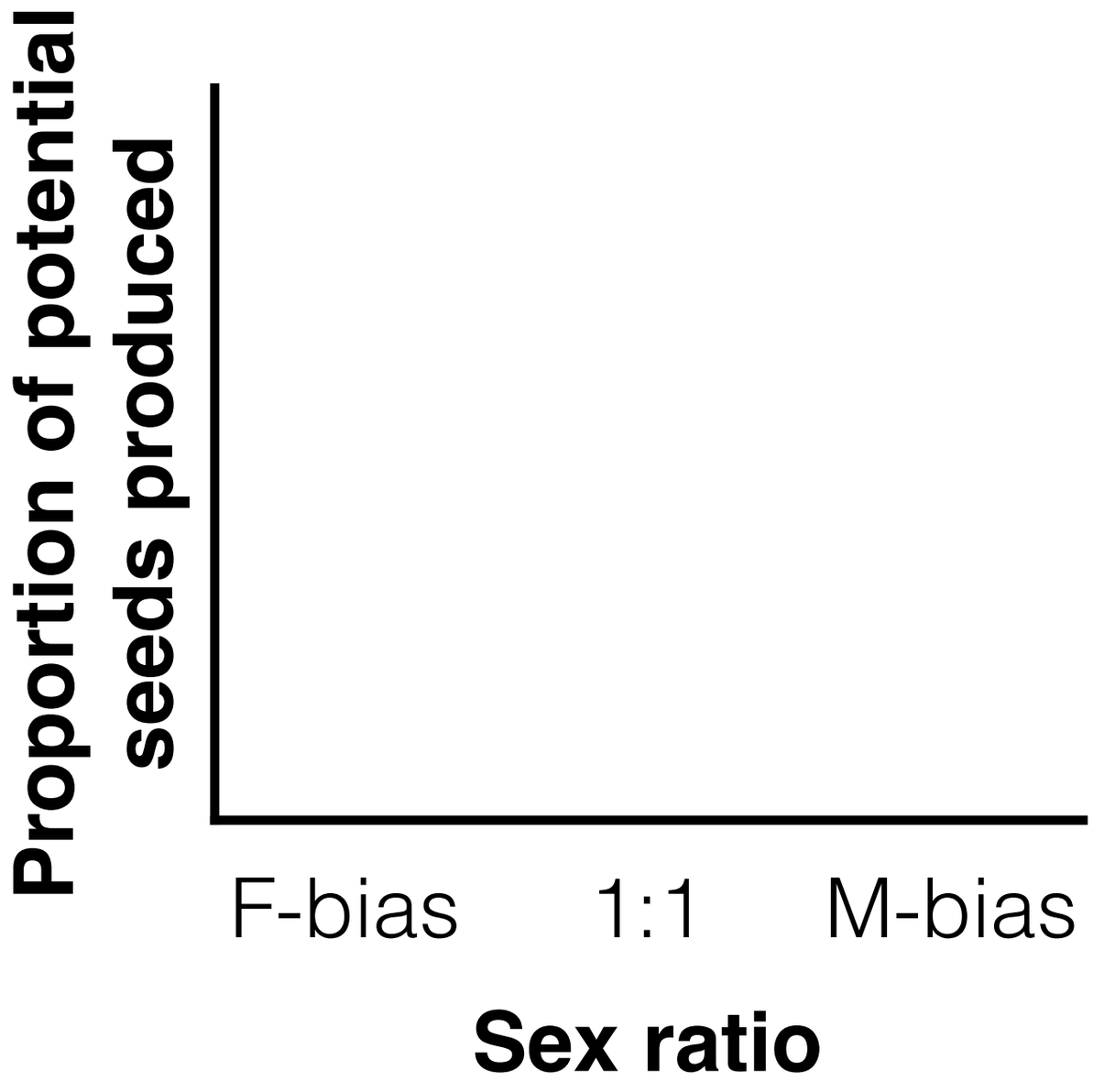


Frequency dependence: The mating function, $\mathfrak{B}$

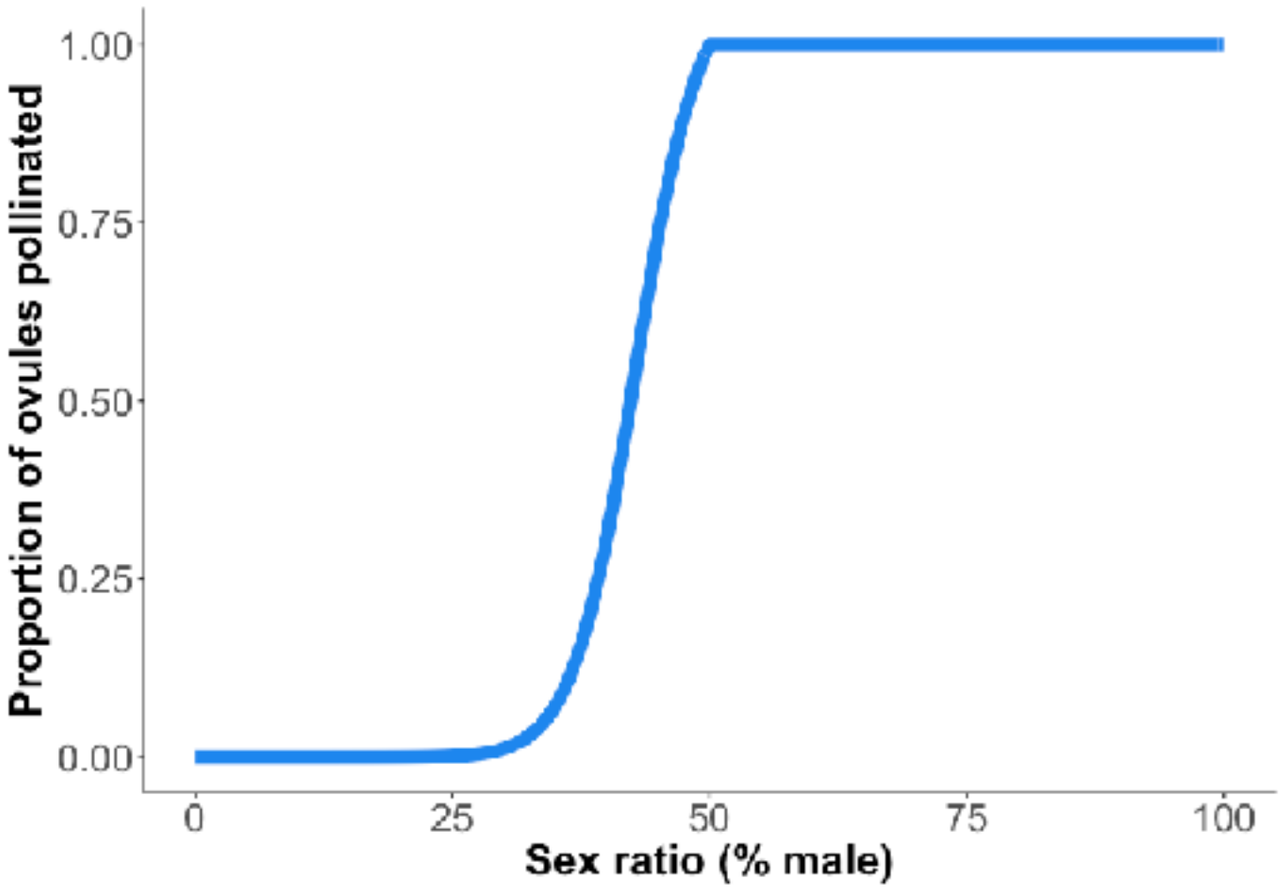
Frequency dependence: The mating function, $\mathfrak{B}$

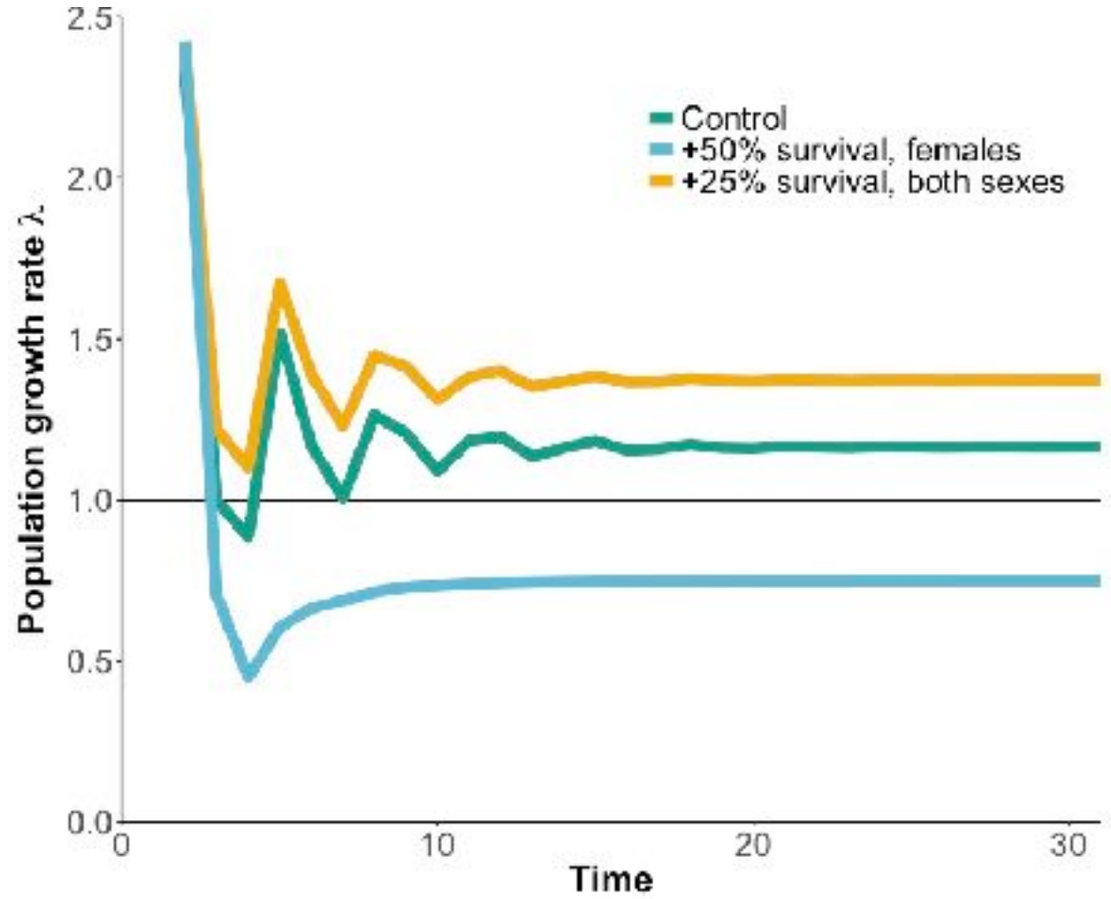
Frequency dependence: The mating function, $\mathfrak{B}$





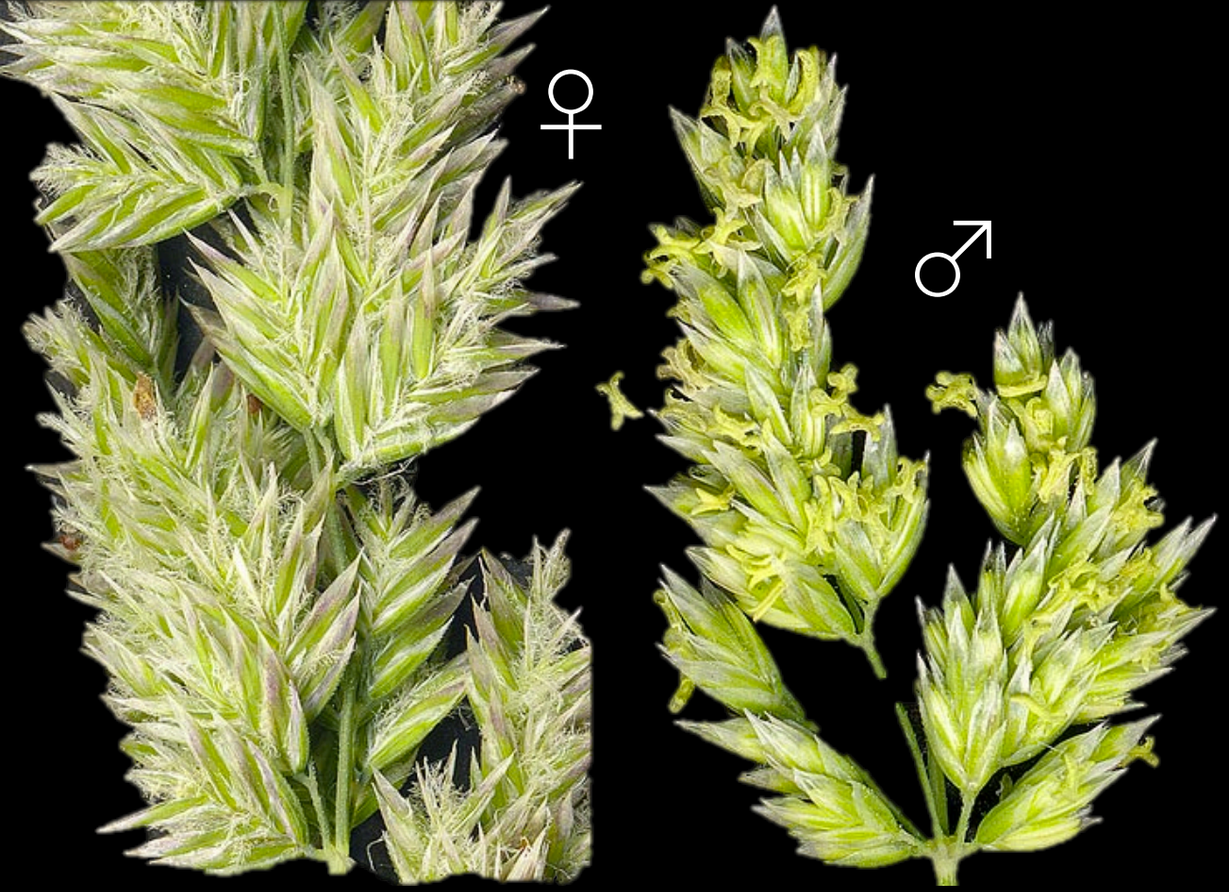
Paradox resolved

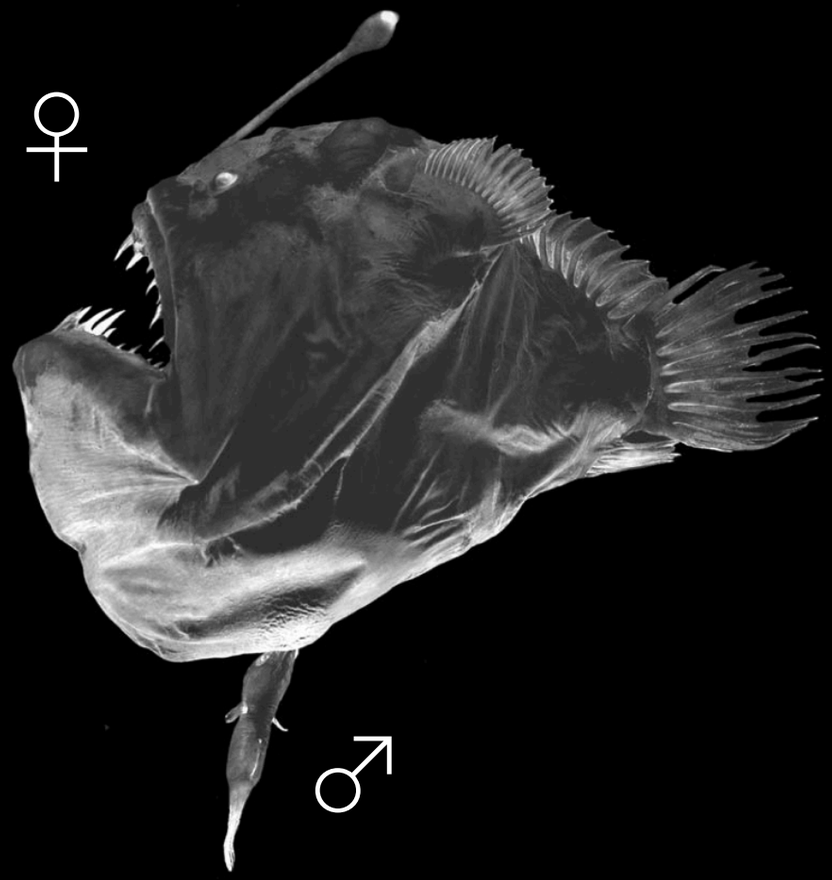




Averaging revisited:
Non-linear population dynamics

R demo





Valeriana edulis

(Caprifoliaceae)

♀

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