

ADAPTIVEDYNAMICS

Exercises 1-3

Exercise 1

Consider the resident-mutant population dynamics in the Lotka-Volterra competition model for the case $s_x(y) = 0$:

- (a) Do a phase plane analysis.
- (b) Write down conditions for (i) non-invasion, (ii) invasion & substitution and (iii) invasion & coexistence.
- (c) Produce a pairwise invadability plot (PIP) if $K(x) = e^{-x^2}$ and $a(x, y) = e^{-\alpha(x-y)^2}$ with $\alpha = 1$.
- (d) Are there evolutionarily stable strategies?
- (e) Which strategies can coexist?
- (f) What can you conclude about the strategy dynamics starting with a monomorphic resident population and assuming small mutation steps?

Exercise 2

Consider the Lotka-Volterra competition model with $K(x) = e^{-x^2}$ and $a(x, y) = e^{-\alpha|x-y|}$ with $\alpha > 0$:

- (a) produce a pairwise invadability plot (PIP).
- (b) How does the result depend on α ?
- (c) Are there any evolutionarily stable strategies?
- (d) Which strategies can coexist?
- (e) What can you conclude about the strategy dynamics starting with a monomorphic resident population and assuming small mutation steps?

Exercise 3

- (a) Which are the four basic assumptions of adaptive dynamics?
- (b) Indicate in the lecture notes “II Lotka-Volterra competition model” (available on the web) where we use each of the four assumptions.