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# Optimal foraging predators in Leslie Gower models with alternative prey

Optimal foraging theory defines the diet choice of a predator by imposing that it chooses the prey that is instantaneously the most beneficial for him [1]. It has been shown that this phenomenon leads to a switching diet and to the persistence of both prey and predators in generalized Lokta-Volterra models [2, 3]. This framework can be useful to study the influence of an introduced alternative prey on a one-prey-one-predator system. In a Lokta-Volterra model, this introduction can enhance predator growth and have negative effects on the main prey, which is called *apparent competition* [4].

In this work, we focus on a Leslie-Gower model with two dynamic prey, where the preyed population determines the carrying capacity of the predator population. Optimal foraging aiming at the maximization of the *per capita* growth rate of the predator population then leads to the maximization of its instantaneous carrying capacity. This optimization defines two main regions in the population state space, separated by a dividing plane, and thus three diet strategies. The predator population will have the choice between eating only the main prey, or only the alternative prey, or following a mixed diet. In each of these three regions, the dynamics which are relevant to the predator reduce to a Leslie-Gower model with a stable positive equilibrium.

Depending on the parameters of the system, different global behaviors arise. However, in all cases, there is only a single positive stable equilibrium, which can potentially lie on the dividing plane; the equilibrium is such that its predator population is larger or equal than that in the absence of the alternative prey. Also, the presence of an alternative prey is never detrimental to the main prey; so the *apparent competition* does not hold.

## References

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