

# Prey composition in the Lotka-Volterra apparent competition

## system with a shared predator

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Apparent competition is defined by Holt (1977, 1984) as a negative indirect effect between two prey species which have a shared predator and have no direct interaction between them. In a system of one predator and its two prey species, one prey population plays a roll to increase the predator population size, so that the other prey population can be regarded as indirectly affected by the former prey population even if no direct interaction exists between them. There have been lots of previous ecological works related to the apparent competition, in which the effect of predation on the diversity of competing prey species was mainly discussed. However, the "apparent competition" effect has been used today for the theoretical discussions in a variety of contexts which transcend ecology, including pest control, immune dynamics, and epidemics. In nature, the members of a food web are always subjected to change on a long-time scale following species extinctions and invasions. Morris et al. (2004) successfully demonstrated the long-term apparent competition in natural communities of herbivorous insects and gave a suggestion that the interactions mediated by shared natural enemies may be a significant factor in structuring natural communities.

In this work, we analyze the Lotka-Volterra n preys -1 predator system in which prey species have no direct interaction among them. Prey species have only indirect interactions, that is, the apparent competition via the shared predator. We analyzed the partially generalized system in Holt (1977) and we found the necessary and sufficient condition to determine which equilibrium state becomes globally asymptotically stable, since the system necessarily has a globally asymptotically stable equilibrium state. We investigated the transition of the equilibrium state due to the extinction or invasion of a prey species into the system. With the results, we shall try to discuss which prey species a generalist predator could coexist with and how the apparent competition works to balance the equilibrium state.

#### References

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