

Switching strategies, population dynamics, and mechanisms of co-existence in food webs with Jekyll-and-Hyde species

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ABSTRACT

Definition: Intra-guild predators prey on members of other species that belong to the same guild.

Question: What are the effects of polymorphic intra-guild predators on population dynamics and diversity?

Mathematical method: We use differential equations to model a specific form of trophic polymorphism where the polymorphic species is an intra-guild predator. This species can switch between two morphs – Jekyll, which competes with the intra-guild prey for a shared resource, and Hyde, which preys on the intra-guild prey. For generality, we explore two different food web arrangements (with and without cannibalism of Hyde on Jekyll) and two different switching strategies (constant and variable).

Key assumptions: We assume that switching between the morphs occurs continuously and in both directions. We also assume that switching is cost-free.

Conclusions: Switching in general stabilizes population dynamics, except in the case of the cannibalistic food web with variable switching. Population subsidies from one morph to the other create ecological opportunity for a specialist species with identical ecology as the subsidizing morph. Switching enhances opportunities for co-existence with the intra-guild prey when Hyde subsidizes Jekyll. However, when Jekyll subsidizes Hyde, opportunities for co-existence with the intra-guild prey are diminished.

Keywords: intra-guild predation, mechanism of co-existence, phenotypic switching, trophic polymorphism.

INTRODUCTION

Predation can promote the co-existence of two consumer species competing for a common resource. This can occur in one of two ways. First, a distinct predator species preys more successfully or heavily on the consumer species that is itself the better competitor in the

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