Ontogenetic bottlenecks

Effects on intraguild predation systems and ecosystem efficiency

Birte Reichstein

Akademisk avhandling

som med vederbörligt tillstånd av Rektor vid Umeå universitet för avläggande av filosofie doktorsexamen framläggs till offentligt försvar i Lilla hörsalen (KB3A9), KBC-huset,
fredagen den 25 September, kl. 14:00.
Avhandlingen kommer att försvaras på engelska.

Fakultetsopponent: Prof. Priyanga Amarasekare,
Department of Ecology and Evolutionary Biology, University of California Los Angeles, USA.

Department of Ecology and Environmental Science
Umeå University
Umeå 2015

Organization
Umeå University
Department of Ecology and Environmental Science

Document type
Doctoral thesis

Date of publication
04 September 2015

Author
Birte Reichstein

Title
Ontogenetic bottlenecks – Effects on intraguild predation systems and ecosystem efficiency

Abstract

Size-dependent differences between individuals in size-structured organisms have fundamental effect on population and community dynamics. Intraguild predation (IGP) is one specifically interesting constellation that often arises when two size-structured populations interact. Ontogenetic bottlenecks that determine population size-structure are affected by both population intrinsic as well as population extrinsic factors, and are therefore context-dependent. Surprisingly, size-structured IGP systems have mainly been investigated theoretically and especially long-term empirical studies are widely lacking. In this thesis I investigate empirically how habitat complexity, interaction strength, and stage-specific resource availabilities affect population processes and their effects on the dynamics of a size-structured IGP system. I conducted multi-generation experiments in a size-structured IGP system, with the Least Killifish (*Heterandria formosa*) as IG prey and the Common Guppy (*Poecilia reticulata*) as IG predator. With no alternative resource next to the shared resource, IG predator and IG prey could not coexist. Weak interactions only increased IG prey and IG predator persistence times and observed exclusion patterns depended on habitat complexity. An alternative resource for either the juvenile IG predator or the juvenile IG prey on the other hand promoted coexistence. However, this coexistence was context-dependent. Ontogenetic bottlenecks played a central role in the dynamics of the size-structured IGP system in general. In the final study I show that an ontogenetic bottleneck can, through changes in stage-specific resource availabilities, be affected in a way that leads to increased trophic transfer efficiency with potential effects on higher trophic levels.

Overall, the results emphasize importance of the broader context in which size-structured communities are embedded. Especially, when managing natural communities it is important to account for the combined effects of size-structure, stage-specific resource availabilities, and habitat structure. Specifically, when managing species that connect habitats or ecosystems all life-stages' environmental conditions must be consider in order to ensure strong predictive power of tools used for ecosystem management planning.

Keywords
Mixed interactions, cannibalism, life-history omnivory, ontogenetic niche shifts, population regulation, biomass overcompensation, biomass production, ontogenetic asymmetry, indirect effects

Language
English

ISBN
978-91-7601-299-4

Number of pages
38 + 5 papers