

ECOLOGY

Ontogenetic dietary shifts in an apex predator, the Japanese giant salamander

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Abstract

Species exhibiting gigantism, particularly apex predators, play a crucial role in food webs, shaping ecosystem structure and function. In species with exceptionally broad size ranges, growth may drive ontogenetic dietary shifts (ODSs)—changes in diet across an individual's lifespan—leading to a pronounced increase in trophic position (TP). Larger individuals may gain access to prey higher in the food chain and inaccessible to smaller conspecifics, eventually becoming apex predators. In this study, we investigated ODSs for the first time in one of the world's largest amphibians, the Japanese giant salamander (*Andrias japonicus*), focusing on how changes in prey consumption and trophic position relate to individual body size. We combined stomach content analysis (SCA) and stable isotope analysis (SIA), incorporating isotopic mixing models to assess how key trophic metrics vary with body size. We identified pronounced ODSs: smaller individuals primarily consumed small aquatic insects, whereas larger salamanders predominantly fed on fish, anurans, and freshwater crabs. These dietary shifts were mirrored in a non-linear increase in TP with an inflection point indicating a sharp increase. This transition likely reflects morphological and physiological adaptations associated with gigantism, enabling exploitation of larger prey. Overall, our results suggest that gigantism in predators such as giant salamanders may be adaptive by facilitating access to higher trophic levels through extended growth, ultimately allowing individuals to function as apex predators. These findings underscore the ecological significance of gigantism and

emphasize the importance of conserving this threatened endemic species within its natural habitat.

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