

Adaptation in the Hawaii akepa to breed and moult during a seasonal food decline

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ABSTRACT

Question: How can a bird breed and moult during a seasonal food decline?

Hypothesis: Nestling overgrowth (weighing more than adults by storing fat) during the period of relative plenty enables parents to bank their parental care in the bodies of their nestlings for use when they are fledglings during leaner times when the parents are moulting.

Organism: Hawaii akepa (*Loxops coccineus coccineus*).

Field site: Hakalau Forest National Wildlife Refuge, Mauna Kea, Island of Hawaii, HI, USA.

Methods: We documented breeding, moulting seasonality, and seasonality of canopy arthropods of *Metrosideros polymorpha*. We weighed and measured nestlings and fledglings to document ontogeny. We tracked fat and mass changes of adults and offspring throughout the 4-month long fledgling period to assess condition in relation to food availability.

Conclusion: Nestling overgrowth is the outcome of an adaptation of offspring to consume and use more than they need at the time and of parents to provide that additional food. The newly documented role of overgrowth enables fledglings to continue to grow while parents are heavily moulting primary flight feathers during deteriorating food availability.

Keywords: breeding season, moult–breeding overlap, nestling overgrowth.

INTRODUCTION

The annual cycle of an organism consists of a sequence of events that each influence survival and current or future reproductive success. For most organisms, breeding is the most energetically expensive activity of the year, and natural selection is assumed to time breeding with suitable conditions (Lack, 1954). Even for tropical organisms, for whom the environment may be much less seasonal, there can be strongly seasonal breeding (Leigh *et al.*, 1996). Following breeding, or perhaps concurrent with it, there can be expensive self-maintenance activities such as replacing integumentary structures. Among vertebrates, only birds and mammals have seasonal moulting of such structures (Ling, 1972). Only birds moult structures (feathers) that are involved in generating lift and thrust for locomotion.

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