The role of social behavior in buffering populations from extinction: Persistence of an endangered, cooperatively breeding passerine

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Cooperative breeding as a buffer

Yes, in cooperative systems, because individuals are cooperating & not competing
- Cooperative groups consist of breeders and helpers (usually retained offspring)
- Greater densities of animals possible without negative feedback, as occurs in monogamous systems
- Helpers can fill empty breeder slots, buffering decreases in reproductive success
- Stochasticity may lead to greater risk for extinction in monogamous populations

Project goal
To understand how social behavior can affect extinction risk in small populations

Hypothesis 1
- Buffeting of population persistence is maintained years after habitat loss in a cooperative breeding system
- In monogamous species, by contrast, habitat loss leads to crowding (and decreased reproductive success), but the effect is temporary (time lags of 200 d to several years)

Hypothesis 2
- Cooperative breeding social systems will exhibit the greatest population persistence, particularly for small populations, than will alternative mating systems (monogamy, types of polygamy)

People
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Persistence of small populations

Extinction in small populations is driven by stochastic and deterministic effects

After deterministic forces make a population small, stochastic forces (uncertainty) were thought to be the 1st cause of decline
However, some deterministic forces, such as social behaviors, can also play a role when populations are small, causing positive feedback cycles that increase extinction risk

Allee effects are social behaviors that increase extinction risk
Low per capita reproduction at low population sizes due to:
- Difficulty finding a mate
- Lack of stimulus for mating
- Breakdown of predator defenses

Can some social behaviors buffer or ameliorate risk?

The White-breasted Thrasher (WBT)

Good system to address questions about extinction and social behavior
- The WBT is an Endangered songbird endemic to two small Caribbean islands (St. Lucia and Martinique), and thus anticipating and preventing its extinction is important
- It is a cooperative breeder, groups are composed of 2 breeders and 0-4 helpers
- In 2005, one-third of the species’ global habitat was destroyed or disrupted by resort developers; >1200 adults remain
- Demographic data exist from before and immediately after habitat loss
- I have studied WBTs in St. Lucia for several years, and have part of the population individually color-banded

Field work
- We performed fieldwork in the St. Lucian Mandelé range (site of the development) in June-August 2011 (during the WBT breeding season), 5 years after habitat loss
- We gathered breeding-season data on WBT sociality (family make up), reproductive success, and survival at 63 nests. Our approach was to search habitat for nests, using a combination of GPS coordinates of previous nest sites and systematic searches.
- At a subset of these nests, we captured, banded, and aged birds not already banded
- We monitored survival by resighting banded WBTs via systematic searches on the resort property, as well as areas previously extensively studied. We resighted 29 WBTs during this fieldwork, we evaded:
- Stinging vines, thorny trees
- Mosquitoes, chiggers
- Biting ants
- Tarantula wasps
- Boa constrictors
- Venomous fer-de-lance
- Tarantulas

Work is ongoing
- Further results of these and other analyses are being prepared for publication. Published results will be available from TIE
- Currently developing an algorithm to model individual interactions in a CB system, which will be implemented in MATLAB to build behavior-dependent individual-based models (Hypothesis 2)

The story 5 years after habitat loss

Cooperative breeding (CB) results
Prediction: groups with > 2.8 adults
We saw: 2.94 adults/group
Groups are continuing to increase 5 years after habitat loss, and are significantly larger than groups before habitat loss

Prediction: > 50% of the population cooperative breeding
We saw: 62.86% cooperative groups & 37.14% lone pairs

Reproductive success (RS) results
Prediction: RS rates similar to <0.1 yr after habitat loss
We saw: no significant change in next success (% of nests fledging ≥ 1 chick) between time periods

2011 preliminary results of increased cooperative breeding and stable reproduction support our buffering hypothesis (Hypothesis 1)

Living lab

Location of the WBT Northeast and Mandelé (enlarged in inset) ranges in St. Lucia. Within the resort site (gray polygon in inset), the green polygons represent forested areas; all other land within the development site is deforested. Much of the forest currently on the resort property will be cleared as construction continues over the next several years. Black dots are locations of the 63 nests we monitored.