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Do *Tachycineta* swallows use public information to choose nest sites?

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Summary

1. In many species of birds, about half that achieve breeding age die after their first attempt. If there is spatial variation in reproductive success, choosing where to breed could thus be paramount to their lifetime Darwinian fitness. How birds make decisions about where to breed is thus of significant interest.
2. The Public Information Hypothesis (PIH) posits that birds acquire information about where to breed by prospecting for future nest sites using information that is shared (inadvertently or not) by neighbouring birds. The information would intuitively include reliable metrics of future spatial variation in reproductive success.
3. *Tachycineta* swallows readily breed in nest boxes, allowing for manipulation of apparent reproductive success of entire neighbourhoods, and providing opportunities for both observational and experimental tests of the PIH.
4. Using data from ** *Tachycineta* populations of ** different species in North and South America, we tested whether variation in metrics of reproductive success (initiation date, clutch size, number of young hatching, number of young fledging) was associated with variation in the same metrics in neighbourhoods of nest boxes in the subsequent year. We also tested whether natal and breeding dispersal were affected by the same PI.
5. In total, we performed ** tests, and found support for the PIH in ** cases. Results ** by year or geographic location, and were ** by experimental manipulation. Thus, contrary to prediction, our results collectively suggest that PI is not used or is not important to *Tachycineta* swallows decisions about where to breed.
6. One explanation for our failure to find support for the PIH is that nest boxes have artificially high reproductive success, and that there is insufficient spatial variation in reproductive success. However, spatial variation in reproductive success does occur in several of our nest box populations (particularly those where predator guards are not used). Moreover, studies on other cavity-nesting birds have found support for the PIH. Thus, it remains to be determined what distinguishes bird species for which the PIH is not supported.

Key-words: clutch manipulation, public information, *Tachycineta albilinea*, *Tachycineta bicolor*, *Tachycineta leucorrhoa*, *Tachycineta thalassina*

Introduction

Breeding locations vary in several key variables, including probability of predation and availability of food for offspring (Martin 1995; Clark & Shutler 1999). Poor decisions about where to breed may be fatal for current sets of offspring and even to parents. For short-lived organisms with limited breeding opportunities, decisions about where to breed are even more crucial. Concomitantly for short-lived species, there are fewer opportunities to learn from mistakes, putting even greater premiums on immediate good decisions. Increasingly, researchers are recognizing that local conspecific breeders inadvertently (or not) provide potentially valuable information about where to breed (Stamps 1994; Muller et al. 1997; Doligez, Danchin & Clobert 2002; Valone 2007), the so-called the Public Information Hypothesis (PIH). We tested the PIH using several years of data from several populations ranging from Alaska to Argentina of four species of swallows in the genus *Tachycineta*. In some cases, breeding success was manipulated by either increasing or decreasing clutch or brood sizes, lending experimental rigour to our tests.

Mortality for many passerines is approximately 50% between successive nesting attempts, including for tree swallows, *Tachycineta bicolor* (Robertson, Stutchbury & Cohen 1998, Shutler & Clark 2006, Winkler et al. 2011), so there is significant selection on making a correct decision about where to breed. If *Tachycineta* swallows acquire public information, they may do so by prospecting (Stutchbury and Robertson 1985, Reed et al. 1999). Although information that prospecting birds gather is not known with certainty, reliable indices of current reproduction could include vocalisations of broods, rates of feeding by parents, presence of young in the nest, density of fledglings, or simply old nests (Erckmann et al. 1990, Safran et al. 2007; Sergio et al. 2007; Forsmann et al. 2008).

We acquired data on reproductive success and dispersal from four species of *Tachycineta* swallows (*bicolor, thalassina, albilinea*, and *leucorrhoa*) from as far north as Fairbanks, Alaska (65˚N) and as far south as Chascomus, Argentina (36˚S). The four species are all closely related and belong to a monophyletic clade (Whittingham et al. 2002), but there is significant spatial, temporal, and species-specific variation in life histories. These birds share the trait of using nest boxes for breeding, and thus have become favoured species for study. Using data from these species, we provide one of the most thorough tests of the PIH to date.

Methods

Data in this paper were collected and contributed by members of a research network called *Golondrinas de las Americas* (see <http://golondrinas.cornell.edu>) as well as additional participants outside the network. Members of *Golondrinas* use similar procedures to routinely gather data on *Tachycineta* reproduction. At most sites, nest boxes for tree swallows were erected ~1.5 m high and $\geq$ 20 m apart (Muldal, Gibbs & Robertson 1985), generally close to aquatic habitats (i.e., from which adult stages of aquatic insects emerge and provide a key food source for swallows; Hussell and Quinney 1987). For **. Boxes were usually visited every 1 to 3 d (up to 7 d) at the start of the breeding season. Adults are captured opportunistically or trapped (when nestlings are ~4 days old) inside nest boxes, and banded with numbered aluminum bands. Boxes are visited regularly to record initiation date (date of first egg) and clutch size (which is deemed to have been reached if it remained consistent for three consecutive days). Visits thereafter are timed to determine date of hatch, and number of eggs hatching.

Nestlings are banded at ~12 days of age, and to prevent premature fledging, visits to boxes usually cease until a final visit 20 or more days after hatch, at which time nests are inspected for presence of dead young. Number of young fledging is number of nestlings at the last visit less those found dead in the nest at this final visit.

In ** cases, trios of nests that were initiated on the same day were randomly assigned to reduce, control, or add manipulations. As many as three eggs or nestlings were removed from a "reduce nest" and placed in an "add nest". The equivalent number of eggs in a control nest were picked up and replaced. Add nests typically produced more, and reduce nests fewer, fledglings than control nests, so that apparent reproductive success was successfully altered by these experimental manipulations (Shutler et al. 2006).

Statistical analyses were performed in SAS version 9.2 (SAS Institute, Cary, NC, USA).

Results

Discussion

Acknowledgments

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