



Floater males gain reproductive success through extrapair fertilizations in the stitchbird

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We used minisatellite DNA profiling to assign parentage to stitchbird, *Notiomystis cincta*, chicks from a breeding population on Tiritiri Matangi Island off the coast of the North Island of New Zealand. The small population size allowed samples to be collected from all potential parents and nearly (33/34 nestlings) complete assignment of paternity. Analysis revealed that 35% of nestlings (12/34) were the result of extrapair copulation and that extrapair young were present in 80% of nests (8/10). About half of the extrapair nestlings were the offspring of unpaired males. This is substantially higher than predicted from the literature, which suggests that extrapair paternity is typically gained by paired males.

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Many species whose mating systems have been categorized according to social associations have recently been re-evaluated since genetic analysis of parentage (Burke & Bruford 1987; Wetton et al. 1987) has revealed either extrapair fertilizations (e.g. house sparrow, *Passer domesticus*: Wetton et al. 1987; great reed warbler, *Acrocephalus arundinaceus*: Hasselquist et al. 1995) or intraspecific brood parasitism (e.g. zebra finch, *Taeniopygia guttata*: Birkhead et al. 1990; purple martin, *Progne subis*: Morton et al. 1990). Results from such studies indicate that there is greater interspecific variability in the extent to which extrapair parentage occurs than previously appreciated (Petrie & Kempenaers 1998), even where extrapair copulations (EPCs) have been observed (e.g. indigo buntings, *Passerina cyanea*: Westneat 1987, 1990).

Research to date indicates that EPCs are part of mixed reproductive behaviours, with paired males seeking copulations with other already paired females (Westneat et al. 1990). Females may also actively seek copulations. Use of DNA profiling allows direct quantification of reproductive success resulting from different behaviours of both males (e.g. red-winged blackbirds, *Agelaius phoeniceus*: Gibbs et al. 1990) and females (e.g. great reed warbler: Hasselquist et al. 1996; blue tit, *Parus caeruleus*: Kempenaers et al. 1992).

One limitation in the use of minisatellite DNA profiling is the number of individuals that can be run together on

a gel. It is relatively easy to sample both putative parents at a nest and test for genetic relationships with any nestlings (e.g. great tit: Verboven & Mateman 1997; reed bunting, *Emberiza schoeniclus*: Dixon et al. 1994). Owing to the nature of running gels, and the generally high mobility of the animals being studied, however, it quickly becomes impractical to attempt to assign maternity and paternity to those cases where extrapair parentage has been revealed. Some studies have attempted to address this question by comparing extrapair young with neighbouring adults (e.g. tree swallows, *Tachycineta bicolor*: Lifjeld et al. 1993; indigo bunting: Westneat 1990). Such studies have revealed that extrapair fertilization is often by other paired males, usually resident on neighbouring territories. As far as we know, only two studies have sampled all possible parents and been able to assign parentage to all nestlings (Gibbs et al. 1990; Hasselquist et al. 1995). Both these studies are consistent with the literature suggesting EPCs were by other paired males. In this study we also sampled all possible parents and aimed to assign paternity to all nestlings.

We had two aims. Our first aim was to document the presence of extrapair parentage in a small, isolated and reintroduced population of stitchbirds, *Notiomystis cincta*. Previous research on stitchbird breeding has reported: (1) the presence of EPCs (Castro et al. 1996); (2) the observation of multimale chases of females during the breeding season (Angehr 1984; Lovegrove 1985); and (3) a reproductive anatomy indicative of a species with intense competition for reproductive success (Castro et al. 1996). Additionally, stitchbirds copulate in a face-to-face position possibly unique among birds (Castro et al. 1996; Ewen 1998). However, no previous study has investigated

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