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### Bigamy in a Male Mockingbird

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Like many passerine species, the Mockingbird (*Mimus polyglottos*) is thought to be highly monogamous. Laskey (1935, *Auk* 52: 370), for example, reports perennial pair bonding between identified males and females, even though the female may leave for the fall and return to the same male during the subsequent breeding season. We report here a case of bigamy coupled with a decrease in parental commitment in a male Mockingbird, precipitated by the disappearance of a male territorial neighbor.

Two color-banded males had maintained adjacent territories in Guilford County, North Carolina for at least 3 yr prior to our observations. During the 1980 breeding season both males had mated and both were feeding newly hatched offspring by the last week in April. On 2 May 1980 (1 day following the fledging of his offspring), one of the two males, designated M2, disappeared and was never seen again. Both prior to and following the disappearance of M2, the behavior of each male had been observed during hourly observation periods. Each period was divided into 120 30-s time bins, and the single occurrence per time bin of each of a number of behaviors, including the feeding of offspring, conspecific agonistic encounters, incubation in the female, and song in the male, was noted. Observation was continued through 31 July 1980, and a total of 50 h of observation was completed following the disappearance of M2.

Observations indicated that the neighboring male (designated M1) began encroaching on the resident female's territory immediately following the disappearance of her mate. During the 2 h of observation conducted on the day M2 was found missing, his mate (designated F2) was observed to engage in 21 agonistic encounters with the usurping male. Most were at or near the original territorial boundary. Despite her defensive efforts, within 2 weeks the aggression subsided, averaging only one encounter per hourly observation period. The intruder had gradually usurped the entire area once held by the missing male. The resident female was not, however, expelled. Throughout the period of observation, both females remained in their original areas, actively defending them from intruders when necessary. During the period immediately following her mate's disappearance, F2 continued to feed her two fledglings alone. On several occasions, F2's offspring were observed begging for food in M1's presence. He was never observed to feed F2's fledglings, however, although his own brood disappeared 3 days after fledging themselves. On 17 May 1980 and 25 May 1980, M1 was observed copulating with F1 and F2, respectively, and by 29 May 1980, both females were found incubating on their respective sides of the double territory. By the end of the breeding season M1 had initiated a total of 5 clutches with the 2 females—3 with F1 and 2 with F2. Only two of these—those with F2—were successfully reared to maturity.

Of considerable interest at this point was the male's parental behavior. Observations of M1's feeding of his first brood (with F1) yielded a male/female feeding ratio of 0.795, calculated over 9 h of observation. Following the disappearance of M2, the two half-sib clutches were begun synchronously. The second M1-F1 clutch was destroyed prior to hatching; the first M1-F2 clutch, however, hatched successfully on 12 June 1980. M1 actively fed his new mate's offspring. Calculation of male/female feeding ratios compiled over 11 h of observation yielded a value of 0.781. When the clutches were not competing with one another, therefore, M1 shared parental duties to roughly the same degree with both mates. Prior to the

fledging of M1's second mate's clutch, F1 was again found incubating the third nest attempted by this pair. These eggs hatched at least 8 days after the M1-F2 clutch successfully fledged. Here then, for the first time, both mates' offspring required male parental care simultaneously.

We completed 5 h of observation spanning 8 days during which his first mate's nestlings and his second mate's fledglings both required care. During this time M1 fed F2's fledglings 24 times; he was, however, never observed to feed F1's nestlings. M1 appeared to have directed his feeding exclusively toward the older offspring of his new mate. The fledglings dispersed at approximately the same time as F1's nestlings disappeared. Shortly thereafter, M1 began construction of two nests, one in each mate's side of the territory. The bulk of his work was devoted to his first mate's nest. This nest was never completed, however, although the female remained in the territory. A third clutch of eggs hatched in F2's section of the territory on approximately 19 July 1980. The nestlings were fed by both M1 and F2, and all three fledged successfully on 31 July 1980.

We conclude that the above account represents opportunistic bigamy in the Mockingbird. In addition, the focus of the male's parental efforts seemed to switch from one female to another. After mating opportunistically with the second female, his parental care was redirected toward her offspring, even though he maintained a bond associated with decreased parental care with his first mate. The observations represent another example of the growing realization that individuals may enjoy greater reproductive success through the opportunistic adoption of mixed strategies [Trivers 1972, Pp. 136-179 in *Sexual selection and the descent of man* (B. Campbell, Ed.), Chicago, Aldine; Maynard-Smith 1974, *J. Theor. Biol.* 47: 209] that depart considerably from what has been regarded as the species-specific norm.

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### Male Starlings Delay Incubation to Avoid Being Cuckolded

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Sperm competition is an inevitable result of anisogamy (Bateman 1948, Trivers 1972). Cuckoldry is a form of sperm competition peculiar to organisms exhibiting extensive male parental care and can be defined as a male's involuntary rearing of another male's offspring as a result of the latter male (the "cuckolder") having inseminated the mate of the former male (the "cuckold"). "Cuckoldry" is not properly an anthropomorphic term, because its root ("cucu") and usage to describe human behavior go back at least to the 14<sup>th</sup> century, when the nest parasitism of cuckoos (*Cuculus* sp.) was used as an analogy for describing marital infidelity (Oxford English Dictionary 1933). Moreover, there is no replacement term for "cuckoldry," and it correctly describes a behavioral complex found in species exhibiting extensive male parental care. "Cuckoldry" as a technical term in evolutionary biology differs from the "nest parasitism" of the bird whose name provides the root word for "cuckoldry" in that in "cuckoldry" the sperm of a parasitic male is *substituted* for the sperm of a host male during fertilization, whereas in "nest parasitism" the egg of a parasitic female is *added* to (rarely substituted for) the egg of a host female during laying. Cuckolding another male should be generally favored, but being cuckolded should be always disfavored, because the cuckold (1) fails to reproduce his own genes or reproduces fewer of them, and (2) promotes the spread of a competitor's genes as though they were his own. Thus, behaviors preventing cuckoldry can be expected to evolve in tandem with male parental care (Trivers 1972, Alexander 1974). Here we present evidence of such behaviors in European Starlings (*Sturnus vulgaris*), including evidence that males avoid participation in incubation until after the end of laying in order to avoid being cuckolded.

Previously, it was known that (1) male Starlings provide extensive parental care, including participation in incubation with females (Kluijver 1933, Kessel 1957), (2) incubation begins before the end of laying in New Jersey (Crossner 1977), and (3) copulation continues throughout laying (Kessel 1957). Viewing these facts in the context of cuckoldry risk, we predicted that (a) only females would incubate before the end of laying, because males could not guard their females from insemination by other males if they themselves were incubating, and (b) males would monitor their mates more closely before the end of laying than after it.

We studied Starlings breeding in our trail of 120 nest boxes on the Livingston College campus of