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Mate switching and mate choice in female Northern Mockingbirds: facultative monogamy.—Northern Mockingbirds (*Mimus polyglottos*) usually are considered monogamous (Laskey 1962, Ford 1983), and some pairs remain together for as long as eight years (Breitwisch, pers. comm.). However, several reports indicate that individual mockingbirds may breed opportunistically in a number of different mating combinations. The most commonly reported deviations from monogamy involve bigamous males that mated simultaneously with two females in adjacent territories, often following the disappearance of a neighboring male resident (Laskey 1941, Logan and Rulli 1981, Breitwisch et al. 1986, Derrickson 1989). Sequential polyandry, in which a female repeatedly paired alternately with two neighboring males within the breeding season, has also been observed (Fulk et al. 1987). I report here a number of instances indicating that female mockingbirds switch mates more often than initially expected for a "monogamous" species. Further, female choice is suggested by the variety of circumstances associated with mate switching.

In the breeding seasons of 1989 and 1990, I observed several instances of females switching mates in a residential population of mockingbirds in Guilford County, North Carolina. From 1 March-1 July, mating status and nesting success were determined by three to four visits per week to each of approximately 25 territories inhabited by mated birds. Eight to 10 territories inhabited by unmated males were visited biweekly. Each visit lasted from 5-10 min, and the status and behavior of each bird was noted. Instances of females switching mates fall into the following three groupings: (1) switches that followed the disappearance of the female's original mate, (2) switches in which a female resided in the territory of one male for a period with no indication of nest building or copulation, and then left his space to breed with a second male in a different territory, and (3) true re-matings involving banded females that nested with one male, left the territory in which he continued to reside, moved into the territory of and re-nested with a second banded male. The numbers below refer to these groupings.

(1) Female BkOBk switched mates both within and between seasons. From spring 1988-spring 1990 she successfully fledged young with at least three different banded males. Each switch followed the disappearance of the male residing in her territory, a pattern common when males disappear. However, this female appeared to be exercising female choice with each re-mating. In no case did a male move into her territory (common when females are widowed). Rather, each time she moved into the territory of her new mate. In early March 1989, she was seen in the territories of four different males. By late March, she remained with one male, with whom she successfully fledged young in 1989 and 1990.

(2) In autumn or early spring, four banded females left the territories of males with whom they had never been known to breed. Each moved into the territory of and nested with a different banded male. One showed the pattern seen before (Fulk et al. 1987), of moving freely across a territory boundary shared by two previously unmated males. In early spring 1990, she nested repeatedly with one of the males and remained with him throughout the remainder of the 1990 breeding season, despite two successive nest failures early in the season. The other male remained unpaired in his territory throughout the breeding season. Three other females were accepted into unmated males' territories in the fall, but moved to the territories of other banded males by the beginning of the next breeding season. Some females remained only a few weeks, but at least two stayed with their first males for three months before leaving. Because they probably never copulated with the first males they encountered, it would be inaccurate to claim that these females switched mates. However, their movements seem to indicate that female mockingbirds exhibit mate choice, leaving the territories of males that have accepted their presence and courted them for an extended period, to nest with other males.

(3) Across both years, true mate-switching, in which females copulated with one male and then renested with a second male while the original male remained in his territory, was seen in four of 33 (12%) of the females. In the first instance, female BROO moved between the territories of two males in 1989 and again in 1990. In 1988, she paired monogamously with her primary mate and spent the fall and winter in their territory. In March 1989, she moved between this territory and that of a newly arrived neighboring unpaired male. In sequence, she nested successfully with both. She first produced young with the second male, abandoned her young to his care at nestling day 11, and switched back to her primary male. Despite the failure of her 2nd, 3rd, and 4th nests, she remained with him through five successive nesting attempts and for the rest of the 1989 breeding season. The other male remained alone in his territory throughout the 1989 breeding season and for the fall and winter. She began the 1990 breeding season by again going back and forth across the males' territorial boundary. Once again, she mated first with her secondary male, but their nest failed, most likely due to cold weather. After the nest loss, her secondary male displaced the first male from his territory. She and her secondary male moved into the contested area, and she nested with him for the remainder of the season. Six of their seven nests were placed in her original territory, the space new to the male. Though he never returned to his original territory, the evicted male was seen in six different locations before June 1990, when he nested successfully with a widowed female four territories distant from his original space.

A second female, BRWW, experienced three unsuccessful nesting attempts with her original mate in their first season together. In each case, a new nest was completed but no eggs were laid. In April 1989, the female moved three territories away into the territory of a previously unmated male. She raised two successful broods with her second mate before he disappeared in May 1990. She remained in the territory for 5–6 weeks feeding two fledglings. During that period, a neighboring mated male moved into her territory and began courting her. Courtship chases, tandem flight, and male nesting displays all were seen before she left the territory, moved two territories away, and mated with a second already mated male. We saw no aggression among any of the females in these territories (e.g., Derrickson 1989).

In the third case, female RGR nested unsuccessfully with one male in 1987. She disappeared in summer 1987 and was rediscovered in spring 1990, having successfully reared young with a second male on the edge of the study area. Her original mate remained unmated from fall 1987 to spring 1990, when he successfully reared two broods with an unbanded female.

In the final instance of true mate-switching, an unbanded female nested successfully with

her primary mate and continued to feed young as she moved back and forth between their territory and that of a neighboring unmated male. Unlike female BROO, she consorted with her second mate while she and her first mate continued to feed nestlings. She copulated with the second male for her final brood of the season. Though he began nest construction just after her first brood of young fledged, she continued to feed her young and did not lay in the nest built by the second male until her fledglings were out of the nest for 14 days.

The differing fates of three females, each of whose mates disappeared in spring 1990, indicate variations in female mate choice. Among the "widows," female PPGR remained in her territory and mated with the male who moved into her territory after the disappearance of her original mate. This pattern is common in this and other populations (Breitwisch, Derrickson, pers. comm.). Female BRWW (see above) left her home territory after the disappearance of her mate, despite the courtship of an already mated neighboring male that expanded his territory into hers. She re-mated with a second already mated male several territories away. Female PBWP remained in her territory for three weeks during which an unmated neighboring male moved into her territory and actively courted her. Despite his extended singing and several nesting displays, the pair never nested, and the female eventually disappeared. Her return the following winter (after the male left) indicated that she indeed left and was not killed.

Females disappeared from the territories of three other mated males in 1990. In two cases, males remained with young which they successfully reared; the third followed a nest failure. While the fate of the females is unknown, it is possible that some moved into the territories of males outside the range of my observations. None of the males re-paired during the 1990 breeding season. This, and the presence of 8–10 territorial males who were unpaired throughout the season, indicate a male-biased sex ratio (seen in other populations as well).

In 1989 and 1990, a majority of the pairs in the population were monogamous, re-nesting repeatedly with the same individual. Seventy-eight percent (18 of 23) and 72% (18 of 25) of the pairings were monogamous throughout the breeding season in 1989 and 1990, respectively. These figures reflect only apparent monogamy (e.g., Gowaty 1985), and they include one male in 1989 and three in 1990 that were classed as monogamous, but that unsuccessfully courted other females after nesting with their primary female. The females of four pairs also classed as monogamous disappeared and were not seen again. For these reasons, the percentages may overestimate the frequency of monogamous pairings. In 1989, 22% (five of 23) females switched territories following active courtship with one male and nested with another male. Three of these each nested with two males within the breeding season. In 1990, 28% of the pairings deviated from seasonal monogamy either by male bigamy (three of 25 pairings) or by females switching territories after active courtship or mating with another male (three of 25 pairings).

Therefore, though many pairs were monogamous, some proportion of the females re-mated despite the original male's continued residence in the population. Others exhibited behavior suggesting that females visit the territories of several males, possibly comparing either characteristics of the territories held by the males or characteristics of the males themselves (Wittenberger 1983). Some females abandoned residency in what appeared to be a high quality home territory in which young had been reared successfully. For example, following the disappearance of her first mate, female BRWW reared her young in her home territory before leaving the territory and the male that occupied it. Although she may have been driven out by the mate of the encroaching male (Derrickson 1989), and since she had mated successfully in that territory, it is unlikely that territory quality alone was the basis of her action. Moreover, in August 1990, she returned alone to her original territory. Similarly, the female who repeatedly moved back and forth between the territories of two males

could have remained in the better of the two if territory quality were the only important dimension.

The occurrence of true mate switching indicates that some female mockingbirds continue to assess their mating choices even after they have paired monogamously for some time. Female BROO mated monogamously in 1988, before beginning a pattern of switching in 1989 and 1990. In addition, true mate switches did not necessarily follow nest failure. In 1989, female BROO abandoned old nestlings to move back into the territory of her primary mate. Further, she remained with him until the beginning of the next breeding season despite three nest failures and continued access to the adjacent male. On the other hand, female BRWW left following the construction of three nests in which no eggs were placed; after her departure both she and her former mate reproduced successfully with new partners.

Though the observations reported here may not apply to more northerly, migratory populations, these observations suggest that some female mockingbirds engage in active mate choice. The observations fit the pattern of successive comparison in female choice described by Wittenberger (1983). Successive comparison is consistent with the mockingbird's dispersed social structure, a male-biased sex ratio, the high level of male parental care typical of the species (Breitwisch 1989, Zaias and Breitwisch 1989), and the year-round territoriality seen in the southeastern United States (Logan 1987). Some females appear to reassess their mating decisions and, as a result, leave their original territory, opting to re-nest with a different male. It is possible that other females also repeatedly reassess, but opt to remain with their mates when the benefits of re-uniting with the same individual outweigh the costs of switching (e.g., Rowley 1983).

Mockingbirds may be preadapted for mate reassessment by the common occurrence of clutch overlap in this species (Logan et al. 1990). During clutch overlap, the female usually stops feeding fledglings, and the male assumes near complete feeding responsibility during the fledgling period (Zaias and Breitwisch 1989). Because the interval for re-nesting during clutch overlap depends upon brood size (Zaias and Breitwisch 1989), females with larger broods may be able to re-nest more quickly by switching to a male unencumbered by parental care. The costs of doing so would be minimized by a male-biased sex ratio. Such conditions would decrease the likelihood that her original male would re-mate, leaving her the option to switch back to her original mate. Consistent with this, Merritt (1985) and Derrickson (pers. comm.) have shown that when females are removed from a territory for a short period, no new females move into the spaces held by males. Finally, when parental load is lessened by decreased brood size, males may increase the likelihood of retaining the female by quickly beginning the nest for the next brood.

In this species, both males and females opportunistically deviate from monogamy. However, it appears that the opportunistic breeding of males is constrained by the demands of territory maintenance. We have no clear instances of mate switching in males, although bigamy is common. I suggest that mate switching is less common in males than in females because males are tied to the territory. Rather than risk losing space, the less costly option for males is to attract a second female or annex an adjacent territory containing a resident widow. In a population with a male-biased sex ratio, a female incurs little risk by leaving the territory of one male or, after being widowed, by opting to leave her territory when it is taken over by a new male.

The factors involved in mate choice in both males and females in this species are undoubtedly complex. However, these observations suggest that both female choice and mate reassessment occur in female mockingbirds. The coincidence in the species of polygamy in both sexes, mate choice and mate reassessment by females, and the maintenance of bonds for as long as eight years, suggest that the monogamy seen in mockingbirds is facultative

monogamy (sensu Ford 1983). That is, when no other opportunities present themselves, or when reassessment indicates that remaining with the same individual yields maximal benefit, monogamy prevails. However, the above observations suggest that this may entail considerable reassessment by females of the availability and value of other mating opportunities.

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