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MATE FIDELITY AND BREEDING-SITE SPECIFICITY OF THE TURQUOISE-BROWED MOTMOT¹

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Although the framework of the reproductive pattern is known for most members of the Neotropical family Motmotidae, and extensive studies have been conducted of several (Skutch 1945, 1947, 1964, 1971; Orejuela 1977, 1980; Scott and Martin 1983, 1986), nearly all long-term (year-to-year) aspects of individual breeding behavior of motmots remains conjectural.

Observations of the activities of several species of motmots evoke the hypothesis that mate and burrow (cavity) fidelity may exist from year to year in this family—Guatemalan Blue-throated Green Motmots (*Aspatha gularis*) and Costa Rican Blue-crowned Motmots (*Momotus momota*) excavate postbreeding burrows (separate from but near to those from which their young were fledged) in which, presumably, they breed

the following year (Skutch 1945, 1964; but, see Orejuela 1977, for possible variation in Campeche *M. momota*); also, Orejuela (1977) has documented mate and site fidelity over two successive years for a single pair of *M. momota*—but corroborative data have not been published. Here, as part of our studies of populations of the Turquoise-browed Motmot (*Eumomota superciliosa*) in Yucatán, México (Scott and Martin 1983, 1986; Martin and Martin 1985), we provide recapture data on 115 banded adults that confirm this hypothesis; additionally, we establish minimum survival records for the species.

STUDY AREA AND METHODS

The study population deposited eggs in beam-socket recesses (holes) in the interior masonry walls of chambers (rooms) of structures at five archaeological sites (Uxmal, Kabah, Sayil, Xlapak, Labná) in southwestern Yucatán, México. Most holes were >2 m above the floors of rooms, >1 m in length, and approximately 10 × 10 cm in cross section. Holes were inspected at least twice weekly throughout the reproductive period (May–August) in 1982 and 1983 during the course of investigation of other aspects of breeding biology; adults were captured there and number-banded on their right tarsometatarsi. Subsequently, birds were recaptured

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TABLE 1. Recapture data (number of birds/category) for 115 banded *E. superciliosa* at Yucatán archaeological ruins.

	Total	Same room as 1982	Same room as 1983	Proximate room	Same hole as 1982	Same hole as 1983	Proximate hole	Same pair member as 1982	Same pair member as 1983	Different pair member
Banded in 1982	43									
Banded in 1982, recaptured in 1983	21	21			17		1	8		2
Banded in 1982, recaptured in 1984	11	11	9		6	9		2	4	1*
Banded in 1983	72									
Banded in 1983, recaptured in 1984	20 ^b		16	4 ^c		13	3		10	1

* Different pair member than in 1983.

^b Approximately 22% less area surveyed and 80% fewer visits made than in either earlier survey.

^c Initial 1983 captures were flushed to recesses or made in main chambers.

opportunistically. In 1984 (our final survey year of breeding *E. superciliosa*), due to constraints imposed by other studies, the period during which visitation occurred was reduced to 3 weeks and confined areally. From 30 May to 19 June, holes were examined from two to six times weekly (totals: Uxmal, 12 ×; Kabah, 8 ×; Sayil, 8 ×; Xlapak, 9 ×; Labná, 8 ×). Two structures at Uxmal and 1 at Kabah, at which approximately 22% of previously marked birds had been banded, were omitted from 1984 surveys. In all years, but particularly 1984, as breeding progressed, inactive (no eggs or young present) holes were dropped from the visitation schedule. Nearly all records are from adults captured in active (eggs or young present at or near to time of capture) holes; fewer than 5% represent captures made outside holes or at inactive holes.

Data presented here (Table 1) must be considered minimal information. Since banding was only ancillary to our basic minimal-disturbance protocol (see Hamilton and Martin 1985) in 1982 and 1983, specific attempts were not made to capture unbanded (or, in 1983, recapture those banded in 1982) hole occupants, and in many instances, only a single bird was captured in an active hole during one season. In 1984, when detailed reproductive studies were not underway, increased effort was made in some areas to capture all occupants of active holes.

Within a season, adults often were recovered at the active hole of their initial capture; only in rare cases, involving fright and/or pursuit by the investigator within a room, were more than two adult co-occupants captured in an active hole during one season. Adults whose weight varied or fluctuated by the approximate weight of one egg at any time during their laying sequence (see Scott and Martin 1986) in an active hole were deemed female; we were able to sex only seven females of this externally sexually monomorphic species by this method.

RESULTS AND DISCUSSION

Year-to-year recapture information is summarized in Table 1. Data from nonproximate rooms (at least two rooms distant) and holes (at least two holes distant or opposite wall), and uncertain data due to flushes to

holes of motmots startled by the investigator or to obvious investigator error were excluded from tabulation.

After an approximately similar hole-visitation schedule in 1983, 49% of our 1982 captures had been recovered. All were in the same rooms as their initial captures; 81% of these, in the same breeding holes; 38%, with the same adults. Members of one pair had separated; each former member of the pair was captured with a different adult in 1983. One was captured in the same hole for all 3 years of the study, but changed its pairing again between 1983 and 1984; the other shifted to a hole in the opposite wall of the room and remained with its 1983 co-occupant in 1984.

In 1984 (reduced visitation), 26% of the adults marked in 1982 were recaptured, all in the same rooms as in 1982 (Table 1). Fifty-five percent of these were captured in the same holes as in 1982; 82%, in the same holes as in 1983 (Table 1). Four retained the same co-occupants as in 1983; two, the same co-occupants as in 1982 (Table 1). Of the motmots banded as adults in 1983, 28% were recaptured in 1984; 80% of those recaptured were in the same rooms as in 1983; 65%, in the same holes; 50%, in the same holes with the same co-occupants (Table 1).

Birds banded in 1982 from active holes were regarded as breeding adults of at least approximately 1 year of age; thus, by 1984 (Table 1), 11 had achieved a minimum age of 3 years.

The pattern of seasonal recaptures of our banded individuals at the same holes supports previous observations indicating within-season monogamy of unbanded Central American (Skutch 1947) and color-marked Mexican *E. superciliosa* (Orejuela 1977, Martin and Martin 1985). Skutch (1947) and Orejuela (1977) also established that both pair members of this species participate in burrow excavation, incubation, brooding, and feeding the young.

Although our data do not exclude the possibility of extra-pair copulation (see Ford 1983, for review), they establish firmly and for the first time that pair bonding and hole tenacity *regularly* is maintained across successive years in *E. superciliosa*. Further observations by Skutch (1945, 1964, 1971) and Orejuela (1977) in-

dicate that intraseason pair bonding and burrow tenacity are features of behavior of other members of this family, and suggest strongly that these behaviors may occur regularly in successive years.

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OBSERVATIONS ON THE BREEDING OF THE ARCTIC WARBLER IN ALASKA¹

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The Arctic Warbler, *Phylloscopus borealis*, breeds commonly along the coastal regions of central and northern Alaska (Gabrielson and Lincoln 1959) and across Eurasia to Northern Sweden (Williamson 1974). Its breeding biology is poorly known (Swanberg 1953; Dement'ev and Gladkov 1968; Kessel, in press). In Alaska only two nests have been described. Both contained chicks near to fledging (Murie 1956). In this note we report observations on 11 nests monitored through the incubation and early nestling stage.

We spent from 29 June to 12 July 1988 camped approximately 15 km from Nome, Alaska (ca. 64°N,

166°W), on the Snake River. The Arctic Warbler breeds commonly in association with willows (*Salix* spp.) along river and stream valleys in the area. All breeding territories appeared to contain at least some *Salix alaxensis* which grows up to 5 m. However, some nests were found up to 20 m distant from *S. alaxensis*, beside clumps of *S. pulchra* which typically grows to 1.0–1.5 m. We located seven nests with eggs by flushing incubating females, and four nests with young nestlings by noting the parents' calls when we were in the nest's vicinity.

NEST CHARACTERISTICS

All nests were located within 1 m of willows on a moss or grass substrate. Two were placed outside the periphery of the willow stands, seven just inside the pe-

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