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## Breeding biology and longevity of Russet-crowned Motmots in central Mexico

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**ABSTRACT.** Motmots, with their distinctive racketed-tails, represent one of the most easily recognized tropical birds, yet little is known about the basic natural history of most species in the family Momotidae. We report basic breeding biology and longevity of Russet-crowned Motmots (*Momotus mexicanus*), a medium-sized Neotropical bird that ranges from northwest Mexico to central Guatemala. We monitored nest success of eight pairs from 1 May to 17 July 1998 in tropical deciduous forests in central Mexico. Motmots laid an average of 4.1 eggs and incubated for approximately 20 d. Four of eight nests fledged young. Of these four nests, average hatching success was 69% and average fledging success was 56%. The mean duration of the nestling period at three nests was 33.7 d. Based on the recapture of one individual bird in April 2008, we provide a longevity estimate that Russet-crowned Motmots can survive at least 11 yr in the wild. These data on nesting success and longevity add to our limited knowledge of the natural history of this understudied species.

**RESUMEN.** Longevidad y biología reproductiva de *Momotus mexicanus* en la parte central de México

Los momótidos, con su distintivo rabo, representan unas de las aves tropicales más fáciles de reconocer. Sin embargo, se conoce poco de la historia natural de la mayoría de las especies que pertenecen a dicha familia. *Momotus mexicanus* es un ave neotropical de tamaño mediano, que se distribuye desde el norte de México hasta la parte central de Guatemala. Informamos sobre la longevidad y biología básica reproductiva de esta especie. Monitoreamos el éxito de anidamiento de ocho pares de estas aves desde el 1 de mayo al 17 de julio de 1998, en un bosque tropical deciduo de la parte central de México. Las aves produjeron una camada promedio de 4.1 huevos e incubaron por aproximadamente 20 días. De cuatro de ocho nidos volaron pichones. De los cuatro nidos exitosos el promedio de éxito de eclosión fue de 69% y el de volantones de 56%. El periodo medio de permanencia de la pichonada en el nido fue de 33.7 días (en tres nidos). Basándonos en la recaptura de un individuo en abril de 2008, estimamos una longevidad promedio de 11 años de la especie en el estado silvestre. Estos datos sobre el éxito de anidamiento y longevidad, aportan a los conocimientos limitados sobre la historia natural de esta especie que ha sido poco estudiada.

*Key words:* breeding biology, clutch size, longevity, Momotidae, *Momotus mexicanus*

Little is known about the natural history of most tropical birds, especially those in the family Momotidae. Our lack of information about motmots is due, in large part, to their habit of nesting in long tunnels in earthen banks. The relative inaccessibility of these nests makes it challenging to study their breeding biology (del Hoyo et al. 2001). Russet-crowned Motmots (*Momotus mexicanus*) are one of the least-studied motmots, despite being a common resident of tropical deciduous forests ranging

from northwestern Mexico to Guatemala. The few studies of Russet-crowned Motmots include behavioral and foraging observations (Smith 1909), inferred breeding times based on the gonadal development of collected birds (Short 1974), brief descriptions of their tunnel-like nests (Amandon and Eckelberry 1955; Rowley 1966), and a recent study indicating high genetic structuring over very short distances (Reyes et al. 2009). Here, we provide some of the first quantitative descriptions of the breeding biology of Russet-crowned Motmots, compare their breeding biology to that of other motmot species and other Coraciiformes, and provide a longevity estimate for Russet-crowned Motmots based on a single recaptured individual.

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## METHODS

Our study was conducted in southern Morelos, Mexico, at a site adjacent to the Reserve of Biósfera de Sierra de Huautla (18°26'21"N; 99°01'27"W). The habitat is seasonally dry tropical forest (Trejo and Dirzo 2000). This region experiences a pronounced dry season from January to April and a rainy season from May to December. During the dry season, most vegetation is leafless except for a few large trees growing along waterways (mainly *Pithecellobium* and *Ficus* spp.). With the onset of the rainy season, the vegetation quickly greens (Bullock and Solís-Magallanes 1990) and there is a dramatic increase in the availability of arthropods. Most birds in this region breed during the beginning of the rainy season.

We monitored nests of eight pairs of Russet-crowned Motmots from 1 May to 17 July 1998. Nests were located in earthen banks along a 1.5-km riparian corridor. We captured 14 motmots either with mist-nets, using conspecific playback and a taxidermic model placed near the mist-net, or by placing a butterfly net over a nest-tunnel entrance. Birds were banded with unique combinations of colored leg bands and a numbered metal band. We used a 1.5-m long fiber optic cable with an attached light source to monitor nest contents and progress. We checked nests every 2–4 d until nest failure or fledging.

Our longevity estimate comes from a second study site, located approximately 5 km south of our main study area, where we captured and banded 33 additional motmots during June–July 1998. Ten years later we returned to the same study site and, during 2 h of netting on 19 April 2008, we re-captured (and released) a Russet-crowned Motmot originally banded 10 yr previously.

## RESULTS

**Breeding biology.** Nests were excavated in earthen banks along the riverbank or roadside. The mean depth of four nest-tunnels was  $133.5 \pm 21.4$  (SE) cm (range = 88–170 cm). The end of each nesting tunnel opened up into a slightly larger chamber where eggs were placed on bare earth. Nest tunnels were often curved, sometimes at right angles, and had relatively flat

slopes without much change in elevation from entrance to nesting chamber.

For the eight nests monitored, the mean clutch size was  $4.1 \pm 0.13$  (SE) eggs (range = 4–5 eggs). Most nests had complete clutches by the time we found them so our estimate of the duration of the incubation period is based on a single nest where the incubation period was 20 d. Eggs hatched and young fledged at four of eight nests. Hatching success for these four nests was 69%, and fledgling success was 56%. However, young that successfully hatched had an 83% chance of fledging, suggesting that most mortality occurred during incubation. The mean duration of the nestling period was  $33.7 \pm 2.7$  (SE) d (range = 30–39 d,  $N = 3$  nests).

Four of the eight nests in our study were predated during late incubation, or soon after hatching. Although we did not observe a predation event, we suspect that snakes and iguanas (*Ctenosaura*) were the primary nest predators because we occasionally observed snake tracks at nest-tunnel entrances and observed iguanas in nesting chambers at the end of nest tunnels.

During behavioral observations at nest sites, we observed both members of a pair excavating nest tunnels and feeding nestlings. The only motmots seen at or near nesting tunnels were banded pairs, so there was no evidence of either polygyny or cooperative breeding.

**Longevity.** The bird used for our longevity estimate was originally captured on 17 July 1998 and was at least 1 yr old (classified at capture as: AHY, after hatch year). We re-captured this same individual (identified based on a numerical metal band) on 19 April 2008, almost 10 yr later. Thus, Russet-crowned Motmots can live at least 11 yr in the wild.

This motmot was likely a male because it was simultaneously netted with a female (whose sex was determined by gonadal inspection), and because the tail wire (region of central tail feathers devoid of barbs; see Murphy (2007a)) was long (19.9 mm) and similar in length to the tail wires of other male Russet-crowned Motmots whose sex was confirmed by gonadal inspection (male tail-wire length: range = 11.0–22.2 mm,  $N = 5$ ; female tail-wire length: range = 10.6–15.1 mm,  $N = 5$ ; unpubl. data). This individual was recaptured approximately 200 m from where it was originally captured.

## DISCUSSION

**Comparison of breeding biology with other motmots.** The breeding biology of Russet-crowned Motmots appears similar to that of other motmots. Russet-crowned Motmots excavate long nesting tunnels into vertical earthen banks in a manner similar to other motmots (Skutch 1945, 1971, Greeney et al. 2006), and their tunnels are similar in size and shape to those of Turquoise-browed Motmots (*Eumomota superciliosa*; mean depth = 130 cm, range = 40–220 cm; Murphy 2008). These tunnels appear to be used only for breeding by Russet-crowned Motmots. Among other motmots, only Blue-throated Motmots (*Aspatha gularis*) are known to use tunnels year-round and use them as overnight roost sites (Skutch 1945).

Similar to the better-studied Turquoise-browed Motmots (Orejuela 1977, Scott and Martin 1983, Murphy 2007a, 2008), Russet-crowned Motmots in our study appeared to fledge a maximum of one brood each year. Second broods may not be possible because Russet-crowned Motmots have relatively long incubation and nestling periods, and they breed during the wet season that peaks for only 2–3 mo. We found that the nestling periods at three nests ranged from 30 to 39 d, and Murphy (2007b) reported similar variation in the nestling periods of Turquoise-browed Motmots (mean = 32 d, range = 27–41 d). We speculate that this variation may be due to differences in the provisioning rates of parents.

We never observed more than two banded birds at a nest site, suggesting that Russet-crowned Motmots are socially monogamous and that there are no helpers at the nest. Both males and females excavated nest tunnels and both fed young. Social monogamy, lack of helpers, and biparental care are also characteristics of other motmot species, including Turquoise-browed Motmots (Scott and Martin 1983, Murphy 2007a) and Broad-billed Motmots (*Electron platyrhynchum*; Skutch 1971).

**Comparison to related species.** The Coraciiformes (including motmots, bee-eaters, kingfishers, todies, and others) have a wide latitudinal distribution and are found throughout the world. Motmots, however, are found only in the New World tropics, ranging from northern Mexico to central South America. Among birds in the order Coraciiformes,

Russet-crowned Motmots typically have smaller clutches (mean = 4.1 eggs) than species in temperate areas, including Belted Kingfishers (*Megasceryle alcyon*, 5–7 eggs; Kelly et al. 2009), European Bee eaters (*Merops apiaster*, 5–8 eggs; del Hoyo et al. 2001), and Blue-cheeked Bee eaters (*M. persicus*, 6–7 eggs; del Hoyo et al. 2001), but have clutches similar in size to those of tropical species, including Cuban Todies (*Todus multicolor*, 3–4 eggs; del Hoyo et al. 2001), Turquoise-browed Motmots (3–5 eggs; Murphy 2007a), Amazon Kingfishers (*Chloroceryle amazona*, 3–4 eggs; del Hoyo et al. 2001), and White-fronted Bee-eaters (*M. bullockoides*, 2–5 eggs; del Hoyo et al. 2001). As reported for a number of species, smaller clutch sizes are typical of tropical birds (Lack 1968) and this also appears to be the case among species in the order Coraciiformes (del Hoyo et al. 2001).

**Longevity.** Although our estimate of maximum longevity is based on a single bird, our recapture of a male 10 yr after its original capture suggests a moderate longevity for a bird of this size (Møller 2007). Furthermore, the recapture of this individual so close to its original capture site suggests extreme site fidelity. Short dispersal distances are characteristic of many resident tropical birds (Brawn et al. 1996, Bates 2000) and are thought to promote unique genetic structuring among many tropical species. In support of our hypothesis that adult Russet-crowned Motmots exhibit site fidelity, Reyes et al. (2009) found high levels of genetic structuring among populations separated by only 25 km.

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