A DESCRIPTION OF THE FIRST MICRONESIAN HONEYEATER (*MYZOMELA RUBRATRA SAFFORDI*) NESTS FOUND ON SAIPAN, MARIANA ISLANDS

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ABSTRACT.—We provide the first descriptions of Micronesian Honeyeater (*Myzomela rubratra saffordi*) nests (n = 7) and nestlings (n = 6) from Saipan in the Mariana Islands. Measured nests (n = 3) averaged 46.7 mm in inner cup diameter, 65.7 mm in outer diameter, 41.3 mm in cup height, and 55.3 mm in external nest height. We found all nests in two species of native trees, 1.47–5.1 m above the ground. Nesting materials were primarily vine tendrils and *Casuarina equisetifolia* needles. We also report observations of parental behavior. Nests, nest placements, and behaviors appeared broadly similar to those reported for this species prior to its extirpation on Guam, and on other islands in Micronesia. *Received 2 May 2005, accepted 26 January 2006.*

The Meliphagidae family (honeyeaters) is restricted to the Australo-Papuan region (Mayr 1945). Micronesian Honeyeaters (*Myzomela rubratra*) occur throughout the high islands (i.e., those of volcanic origin rising more than a few meters above sea level) of Micronesia, with subspecies endemic to Palau (*M. r. kobayashii*), Yap (*M. r. kurodai*), Chuuk (*M. r. major*), Pohnpei (*M. r. dichromata*), Kosrae (*M. r. rubratra*), and the Mariana Islands (*M. r. saffordi*; Pratt et al. 1987). Within the Mariana Islands, Baker (1951) found that birds from Guam, Rota, Tinian, and Saipan are similar with respect to morphometric measurements, and he does not separate them taxonomically. Micronesian Honeyeaters, along with most other native forest birds, were extirpated from Guam in the mid-1980s with the arrival and range expansion of the brown treesnake (*Boiga irregularis*; Savidge 1987, Wiles et al. 2003). Surveys on Rota, Tinian, and Saipan (the inhabited islands of the Commonwealth of the Northern Mariana Islands [CNMI]) have indicated that Micronesian Honeyeaters are less numerous on Saipan than on Rota or Tinian (Pratt et al. 1979, Ralph and Sakai 1979, Jenkins and Aguon 1981, Jenkins 1983, Craig 1996), although Engbring et al. (1986) found that densities were greater on Saipan than on Tinian. On Saipan, Engbring et al. (1986) counted 549 honeyeaters (mean of 2.25 birds per station ± 0.14 SE), and estimated the total Micronesian Honeyeater population at 22,573. In a repeat survey, the U.S. Fish and Wildlife Service (1997) counted 316 honeyeaters (mean of 1.30 birds per station ± 0.09 SE; no population estimate given), indicating a possible decline in the honeyeater population between survey periods.

Little research has been published on the avifauna of the Mariana Islands, and many detailed aspects of life histories are unknown for most native and endemic species (Rodda et al. 1998, Mosher and Fancy 2002). This lack of information hampers the development and implementation of conservation plans. Despite interdiction measures, the number of brown treesnake sightings on Saipan has increased in recent years (Rodda et al. 1998; N. B. Hawley pers. comm.); although definitive proof is lacking, 75 plausible brown treesnake sightings and 11 hand-captured brown treesnakes on Saipan (Gragg 2004) indicate that an incipient population of snakes is now established (Colvin et al. 2005). Thus, information on the ecology and breeding biology of all avian species in the CNMI is urgently needed so that captive breeding programs can be implemented.

We undertook a study to assess nesting success of common forest passerines in native and nonnative forests of Saipan. Micronesian Honeyeaters were not a target species for this study, as they are reported to be more com-

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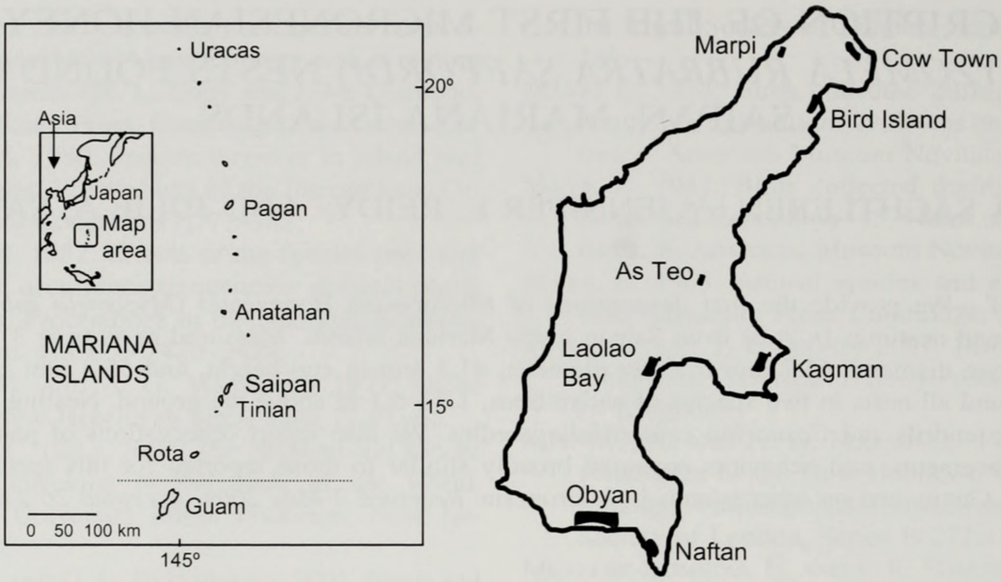

FIG. 1. Location of Saipan within the Commonwealth of the Northern Mariana Islands, and Saipan study sites (shaded areas) in which we searched for nests of native forest birds during 2003 and 2004 to assess nesting success; Micronesian Honeyeater nests were found at Marpi, As Teo, Kagman, and Laolao Bay. Marpi, As Teo, and Kagman study areas were native forest; Cow Town, Bird Island, Obyan, and Naftan were nonnative tangantangan forest; Laolao Bay was mixed native/agriforest. Approximate coordinates (taken at the nearest open area, generally a road) for study sites were as follows: As Teo 15° 11′ N, 145° 45′ E; Bird Island 15° 15′ N, 145° 48′ E; Cow Town 15° 16′ N, 145° 49′ E; Kagman 15° 09′ N, 145° 16′ E; Laolao Bay 15° 09′ N, 145° 44′ E; Marpi 15° 16′ N, 145° 47′ E; Naftan 15° 06′ N, 145° 44′ E; Obyan 15° 06′ N, 145° 43′ E. The dotted line on the location map signifies the division between the Territory of Guam and the Commonwealth of the Northern Mariana Islands.

mon in coconut plantings, shrubbery and gardens of villages, scrub, coastal strand, and diverse second-growth forest composed of both native and introduced trees (Seale 1901, Safford 1902, Pratt et al. 1979, Jenkins 1983, Engbring et al. 1986). Over the course of our study, however, we incidentally found seven Micronesian Honeyeater nests. To our knowledge, these are the first nests of this species found on Saipan, although nests have previously been found on Guam, and one nest has been found on Rota. Here, we describe nests and nestlings from Saipan and compare these descriptions with those from Guam, Rota, and other islands in Micronesia from which information is available.

METHODS

Study area.—Saipan, located in the western Pacific Ocean (15° 10′ N, 145° 45′ E; Fig. 1), encompasses a land area of 123 km^2, and is the second largest island in the Marianas. The island has a tropical climate with an annual mean temperature of 28.3° C and mean annual rainfall of 200–250 cm. The timing of the wet and dry seasons varies somewhat between years, but the wet season usually extends from July to November and the dry season from December to June. Typhoons may occur at any time, but are most frequent between August and December (Young 1989, Mueller-Dombois and Fosberg 1998).

We focused our study on two forest types—introduced tangantangan (*Leucaena leucocephala*) forest and native limestone forest. Most (77%) of the forest remaining on Saipan is nonnative (Falanruw et al. 1989), and tangantangan forest is estimated to cover 28% of the island. This tree species grows in dense, near-monocultures on flat lowlands and plateaus (Craig 1990). Native limestone forest is restricted to cliffs and less accessible areas not easily cultivated (Craig 1989, Stinson and Stinson 1994), and is estimated to cover only 5–19% of Saipan (Engbring et al. 1986, Young 1989). *Pisonia grandis* and *Cynometra ramiflora* dominate the canopy of this forest type, and *C. ramiflora* and *Guamia mariannae* are the most common species in the understory (Craig 1996). Study sites were selected in three native, four nonnative, and one mixed forest (Fig. 1). The mixed forest contained common native and agriforest trees, including coconut (*Cocos nucifera*) and mango (*Man-*

gifera indica). Study areas were delineated by transects marked with flagging.

Avian surveys.—We conducted our study from April to July 2003 and February to May 2004. Micronesian Honeyeater nests were found while searching line transects according to distance sampling methodology (Buckland et al. 2001) or incidentally while moving through the forest to monitor nests of other species. When found, each nest was flagged and assigned a unique nest identification number. Nest contents were visually checked and described at 3-day intervals, using a mirror on a telescoping pole if necessary. We did not handle nest contents while nests were still active; thus, no egg measurements were made, and we visually estimated nestling characteristics by using a millimeter ruler for comparison.

After each nesting attempt was completed, we measured the nest's height, distance from trunk, and number and diameter of supporting branch(es). Tree species and tree height were also recorded. We used a clinometer to measure nest and tree heights (unless these could be measured directly with a steel measuring tape), a steel measuring tape to measure distance from the trunk, and a millimeter ruler to measure diameters of supporting branches. We also estimated the distance between the nest and the nearest road in 25-m categories (≤25, 26–50, 51–75, 76–100, and >100 m). Nests were collected if possible and measured with a millimeter ruler, after which they were labeled and given to the CNMI Division of Fish and Wildlife on Saipan.

RESULTS

We discovered seven honeyeater nests on 31 May 2003, and on 17 February, 9 March, 12 March, 7 April, 9 April, and 26 April 2004. Two nests contained eggs, two contained nestlings, and two were empty when located. The female was sitting on one nest and was not disturbed; in this case the nest contents were not determined when the nest was discovered. No adults were in attendance at three nests upon initial discovery. Four nests failed (three during incubation and one at an undetermined nesting stage), and three fledged young. Four nests were located in mixed forest, and one nest was located in each of the three native sites. All six nests in which we observed contents contained two eggs or two young. Initially, we mistook two nests for Bridled White-eye (*Zosterops conspicillatus saypani*) nests due to their similar size, structure, and placement. However, we noticed that the nests of Micronesian Honeyeaters tended to have thinner walls and deteriorated more rapidly than Bridled White-eye and Golden White-eye (*Cleptornis marchei*) nests, which they otherwise closely resembled.

Nest composition and structure.—Only three nests were accessible and in adequate condition for measurement. Cup heights were 39, 40, and 45 mm (mean = 41.3 mm), and nest heights were 41, 50, and 75 mm (mean = 55.3 mm). Internal diameters were 43, 47, and 50 mm (mean = 46.7 mm), and external diameters were 55, 69, and 73 mm (mean = 65.7 mm). Nests were composed of vine tendrils and *Casuarina equisetifolia* needles (Fig. 2), and part of a leaf skeleton from a native *Pandanus* sp. was entwined around the outer base of one nest.

Nest placement.—Micronesian Honeyeater nests were located at various distances from roads (i.e., from <25 to >100 m). Four nests were placed in *Guamia mariannae* and three were placed in a *Psychotria* (genera comprising more than one species in CNMI, and which we could not identify to species level, are listed herein only to the genus level). Nest (and tree) heights in *G. mariannae* were 1.5 m (5.6 m), 3 m (5 m), 3.5 m (6 m), and 5.1 m (not obtained), and in *Psychotria* they were 1.5 m (2 m), 1.7 m (2.3 m), and 3.8 m (8 m). Nests were placed 83–184 cm from the trunk in *G. mariannae* and 0–103 cm from the trunk in *Psychotria*, generally near the outer edge of the tree (Fig. 2). The number of nest support branches varied from two to five in both tree species, and support branch diameter ranged from 1.5 to 9.7 mm in *G. mariannae* and from 1.5 to 2.5 mm in *Psychotria*.

Egg description.—Although four monitored nests each contained two eggs, we had a clear view of the eggs only in the nest found on 26 April 2004. The eggs were creamy white and marked with two distinct rings of brown speckles, one ring near the broad end and the other near the narrow end of the egg.

Nestling description.—Of the three nests from which young fledged successfully, we found two during the nestling stage and one

FIG. 2. Micronesian Honeyeater (*Myzomela rubratra saffordi*) nest photographed on Saipan, Mariana Islands, 19 April 2004, showing its placement at the outer end of the branch.

during the incubation stage. Micronesian Honeyeater nestlings are altricial and closely resemble Bridled White-eye nestlings until they develop red pin feathers. Because nestling development was variable, each nest is treated separately.

The 2003 nest contained eggs when found, and the two nestlings were first seen at day 0–1 following hatching. At this age they were estimated to be approximately 2 cm in length, had dark pink skin, and were downy on their wings and backs. On day 3–4, the nestlings had grown to 3–3.5 cm in length, were still covered with down, and their skin color was dark pink/purple. They appeared well fed, as they had large, rounded stomachs. At day 6–7, when their eyes were beginning to open, the nestlings were 4–4.5 cm long, with wing pins approximately 5 mm in length and back pins beginning to erupt. Their heads were covered in long down. On day 7–8, the chicks were still 4–4.5 cm long, their wing and back pins were 8 and 2 mm (respectively) long, their bills were beginning to curve, and their head pins still had not erupted. Underlying skin color, which lightened progressively throughout nestling development, was pale pink by this stage. At day 9–10, the wing pins were 10 mm in length and tail and head pins had erupted 1 mm. Tan brown feathers had erupted from the wing pins, red feathers were beginning to erupt from the back pins, and 1- to 2-mm head pins were visible on day 10–11. Both nestlings fledged prematurely on day 13–14, when the observer was 1 m from the nest. One nestling was captured and returned to the nest, but the second could not be relocated and was left to the adults who remained nearby and were agitated. At this time, the nestlings were estimated at 5.5 cm in length, but they were not yet fully feathered. Red feathers, 1 mm in length, had erupted on the back, gray feathers had erupted on the head, and 8-mm tail pins did not yet have erupted feathers. The breast was bare. On day 14–15, the remaining nestling's wing feathers had turned dark gray, and it fledged at day 15–16.

The second nest that fledged young was found on 12 March 2004. On that date, the two nestlings were already approximately 4 cm in length, their eyes were open, and they had 2-mm long downy feathers erupting from the pins on their wings, backs, and heads. On 15 March, only one nestling remained. This nestling fledged prematurely on 18 March when the observer approached to ~3 m from the nest. The nestling fluttered away, but it could not fly and was captured and returned to the nest. We estimated the nestling to be 4–4.5 cm long and it did not appear fully feathered. The erupted feathers were mostly black, with small red patches of feathers appearing on the head and back. By 22 March, when the final nest check was performed, this nestling had fledged.

On 9 April 2004, we found the last successful nest by observing the female bringing food to her two nestlings. The nestlings were estimated at 3–3.5 cm in length and were already developing pin feathers. On 13 April, the nestlings were ~4 cm long, covered with long, black pins from which feathers had erupted, and their eyes were open. Three days later, the nestlings were 4–4.5 cm long and their bills were visible over the rim of the nest. They were black all over with no red feathers visible. By 19 April, the nestlings had fledged.

Parental behavior.—Only females were observed incubating (n = 5 nest checks) or brooding nestlings (n = 1 nest check). However, one or both members of the pair were often observed close to the nest. When observed, the adult(s) were always very agitated. Typically, one or both adults would feign injury, fluttering about low to the ground and drooping one wing. If only one adult was present, this behavior was sometimes accompanied by scolding; if both adults were present, one adult would often feign injury while the other scolded. We observed injury-feigning behavior on 9 of 26 nest visits and scolding during 5 of 26; this behavior was observed only at nests containing nestlings. Micronesian Honeyeaters appeared very intolerant of disturbance at the nest during the incubation stage, as each time the incubating female was flushed from the nest during a nest check (n = 3), the nest had failed by the next visit.

DISCUSSION

Prior to our study, nests of Micronesian Honeyeaters had been found on Guam (Hartert 1898, Seale 1901, Yamashina 1932, Jenkins 1983; N. Drahos pers. comm.), Rota (C. C. Kessler unpubl. data), Kosrae and Pohnpei (Baker 1951), Chuuk (Baker 1951, Brandt 1962), Palau (Pratt et al. 1980), and in the southwest Pacific region (Mayr 1945). The amount of information provided varies by source. Nest measurements are variable, with the following ranges reported from Guam: cup height 25–50 mm, outer height 50–120 mm, internal diameter 25–60 mm, and external diameter 35–80 mm (Hartert 1898, Seale 1901, Jenkins 1983; N. Drahos pers. comm.). The measurements of nests we found on Saipan fall within these ranges. In contrast, the average outer height of 18 nests found on Chuuk was 20 mm, considerably shorter than nests from Guam and Saipan, although the average external diameter was similar (50 mm; Brandt 1962). Our nest heights are also similar to those reported from other islands, varying from 1.2 to 4.6 m (Hartert 1898, Seale 1901, Yamashina 1932, Mayr 1945, Brandt 1962, Jenkins 1983; N. Drahos pers. comm., C. C. Kessler unpubl. data).

Similar to our descriptions of nests found on Saipan, nests from Guam, Rota, Chuuk, and Palau have been variously described as "loosely constructed," "fragile," "frail," "not heavily made," and having see-through sides (Brandt 1962, Pratt et al. 1980, Jenkins 1983; C. C. Kessler unpubl. data). In addition, they were found placed among the outer branches of the trees in which they were constructed (Seale 1901, Brandt 1962, Pratt et al. 1980, Jenkins 1983). Unlike the nests we found on Saipan, however, those on other islands tended to be found in open locations, such as the edges of clearings or the outer perimeters of forests (Brandt 1962, Pratt et al. 1980; C. C. Kessler unpubl. data). Reported nesting materials are diverse and include fine roots and fibers, grasses, leaves, ferns, weed stems, and pieces of coconut bast (Mayr 1945, Baker 1951, Brandt 1962). As on Saipan, *Casuarina equisetifolia* needles were included in nests found on Guam.

The chief difference between our observations and those of other authors in the Mariana Islands is the suite of tree species used for nesting. On Saipan, nests were placed in *Psychotria* and *Guamia mariannae* (trees native to the Mariana Islands), whereas nests on Guam were placed in *Pithecellobium dulce*, *Casuarina equisetifolia*, *Delonix regia*, and *Bruguiera gymnorrhiza*, only two of which (*C. equisetifolia* and *B. gymnorrhiza*) are indigenous to the Mariana Islands (Raulerson and Rinehart 1991). On Rota, the nest was found in nonnative *Acacia confusa*. This difference is likely a reflection of other authors working primarily in habitats that were different from those in which we worked (only one of our study areas comprised mixed native and exotic forest), rather than differences in honeyeater habitat use among islands.

All reported clutch sizes are of one or two eggs, although a nest found on Palau contained three nestlings (Pratt et al. 1980). Two- to three-egg clutches are characteristic of the Meliphagidae family (Mayr 1945). Micronesian Honeyeater eggs from Saipan, Guam, Rota, and Chuuk all had a base color of white, off-white, or cream, generally with rufous-brown speckling, although Yamashina (1932) described the speckling as gray and dark yellow-brown. The speckling may be concentrated at the broader end (Hartert 1898, Seale 1901, Brandt 1962, Jenkins 1983), near the narrow end (Yamashina 1932), near both ends (this study), or may be scattered over the whole egg (Brandt 1962).

We found no comparative descriptions of nestlings or data on their age at fledging. However, several authors have described fledgling Micronesian Honeyeaters from Guam. Seale (1901:57) reported that ". . . the young are olive brown above, yellowish on the under parts, washed with red on the sides of the fore breast and back; bill dark, yellowish on the base of lower mandible; feet and iris dark." N. Drahos (pers. comm.) described a pair of fledgling Micronesian Honeyeaters recently out of the nest. The female was mouse gray with a faintly rusty-red chin, her bill was black with a yellow stripe on its edge and the top of her bill was yellow at the base, and her eyes and feet were black. He reported that the male was similar, but the middle of the back, chin, and lower half of the head were faintly cardinal red. Other authors' descriptions are similar although less comprehensive. There are several dissimilarities among our descriptions of nestlings from different nests, and between our descriptions of nestlings and those of other authors. The former may be explained by factors that could affect nestling development, including the number of nestlings present in the nest (thus, whether provisioning must be shared), breeding experience or foraging ability of the adults, or food availability in different study areas. The latter presumably is explained by continued plumage development after fledging. Although our sample size included only two nests, Micronesian Honeyeater nestlings seem apt to leap from the nest before they are fully ready to fledge, which, under undisturbed conditions, seems to be at 15–16 days. Parental distraction displays of Micronesian Honeyeaters on Saipan appear to be the same as those of birds on Guam and Rota, although on Guam and Rota only females have been reported to feign injury (Stophlet 1946, Jenkins 1983; N. Drahos pers. comm.).

Three of the seven nests we found on Saipan were in native limestone forest, which has not previously been reported as preferred habitat for the Micronesian Honeyeater; the species has been considered more common in coconut plantings, shrubbery and gardens of villages, and diverse second-growth forest. Similarly, Cardinal Honeyeaters (*Myzomela cardinalis*) in Samoa are most abundant in village habitats (Freifeld 1999), and Orange-breasted Honeyeaters (*Myzomela jugularis*) in Fiji are most abundant in coconut plantations (Steadman and Franklin 2000). This underscores the importance of obtaining ecological information for all native species to further the development of conservation plans. Some of the habitats in which Micronesian Honeyeaters are reportedly common, such as backyard gardens, would appear unsuitable as nesting habitat, given this species' apparent intolerance of disturbance at the nest and the likelihood of disturbance in these areas.

Overall, we found that Micronesian Honeyeaters on Saipan have nesting requirements and behaviors similar to those on Guam prior to their extirpation. Information on the nesting requirements of Micronesian Honeyeaters on Saipan should aid in the establishment of effective captive breeding programs for this species, and for future re-establishment on Guam and Saipan (if necessary) once brown treesnakes have been controlled or eradicated.

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