

Short Communications

The Wilson Journal of Ornithology 120(1):190–195, 2008

First Description of Nests and Eggs of Two Hispaniolan Endemic Species: Western Chat-tanager (*Calyptophilus tertius*) and Hispaniolan Highland-tanager (*Xenoligea montana*)

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ABSTRACT.—We present the first nest descriptions for two Hispaniolan endemic songbirds, the Western Chat-tanager (*Calyptophilus tertius*) and Hispaniolan Highland-tanager (*Xenoligea montana*) from a montane broadleaf forest site in the Sierra de Bahoruco of the Dominican Republic. Single Western Chat-tanager nests were found on 17 May 2002 and 9 June 2004. Both were coarsely-built, partially-domed, bulky structures 1.0–1.5 m above ground. One nest was freshly-depredated when found, whereas the second contained two eggs which hatched on 19 and 20 June. The nestlings were depredated on 25 June. A Hispaniolan Highland-tanager nest found on 27 June 2004 fledged a single chick the following day. This nest, in a vine tangle 2.5 m above ground, was an open cup structure composed of moss, small herbaceous stems, leaf fragments, lichens, and other plant fibers. We describe the eggs of both species, the nestlings of Western Chat-tanager, and the juvenal plumage of Hispaniolan Highland-tanager. We believe that depredation by introduced feral cats (*Felis domesticus*) and rats (*Rattus* spp.) is a serious problem in these montane forests. Received 26 December 2006. Accepted 16 April 2007.

Hispaniola supports more endemic bird species than any other Caribbean island, but the breeding biology of its avifauna remains poorly known. Breeding bird communities in the

island's high elevation broadleaf and mixed pine-broadleaf forests have received little study because of the remoteness and difficulty of access of these forests. We documented previously undescribed nests of two species during investigations at a montane forest site in the Dominican Republic during 2002–2004. The Western Chat-tanager (*Calyptophilus tertius*) and Hispaniolan Highland-tanager (*Xenoligea montana*) are among the most endangered species on Hispaniola; understanding their breeding biology is fundamental to conserving their populations.

The Western Chat-tanager, recently classified as a species distinct from the Eastern Chat-tanager (*Calyptophilus frugivorus*) (AOU 1998), occupies a disjunct and fragmented range at elevations from 750 to 2,300 m in Haiti's Massif de la Hotte and Massif de la Selle, and in the western Sierra de Bahoruco of the Dominican Republic (Latta et al. 2006). The species inhabits dense understory of moist broadleaf forests where it is secretive and difficult to observe. The International Union for the Conservation of Nature (IUCN) has not recognized the recent split of *C. tertius* from *C. frugivorus*, but still considers the species complex as globally Vulnerable to extinction because of its small range and overall population size (IUCN 2006). Data on abundance and population trends are lacking, but there is little doubt that declines have occurred because of habitat loss throughout Hispaniola (Keith et al. 2003, Latta et al. 2006). Two formerly recognized subspecies are believed to have been extirpated (IUCN 2006).

The Hispaniolan Highland-tanager, also known as the White-winged Warbler (AOU 1998), is restricted in Haiti to mesic montane forest above 1,150 m elevation in the Massif de la Hotte of Haiti. This species was renamed

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by Latta et al. (2006) based on mtDNA analyses showing this species' clear association with the tanagers of Hispaniola (Lovette and Bermingham 2002). It has apparently been extirpated from the Massif de la Selle and other areas of former occurrence. The species' Dominican Republic distribution is limited to elevations above 1,300 m in Sierra de Bahoruco, parts of the Cordillera Central, and on upper slopes of the southern Sierra de Neiba (Latta et al. 2006). The Hispaniolan Highland-tanager is classified as globally Vulnerable by the IUCN (2006) and is considered by some to be one of Hispaniola's most endangered endemic birds (Woods et al. 1992, Latta et al. 2006). No data exist on population size or trends, but local extirpations and ongoing severe deforestation suggest the species is in decline.

The objectives of this paper are to describe: (1) the nest and eggs of Western Chat-tanager and Hispaniolan Highland-tanager, (2) the natal plumage of Western Chat-Tanager, and (3) the juvenal plumage of Hispaniolan Highland-tanager.

METHODS

We conducted studies of the breeding bird community at a montane broadleaf forest site at Pueblo Viejo (18° 12' N, 71° 32' W) at 1,775 m elevation in the Sierra de Bahoruco from May through July 2002–2004. General floristic features of this forest type have been described by Fisher-Meerow and Judd (1989) and Latta et al. (2003). Nest searching was conducted on a daily basis each year, primarily through systematic searching of suitable habitat. We fitted five Western Chat-tanagers with 1.0-g radio transmitters (BD-2 model, Holohil Systems Ltd., Carp, ON, Canada) in 2002 and 2003 and tracked each individual daily to attempt to locate nests. Once located, nests of all species were monitored at 2–3-day intervals through termination (failure or fledging); some nest visits occurred at 1-day intervals. We measured a standardized series of habitat and nest site characteristics following each nesting attempt.

NEST DESCRIPTION

Western Chat-tanager.—CCR found a nest on 17 May 2002 by systematically searching an area in which a radio-marked female and

male had been present during the previous several days. The nest was 1.3 m above ground in an extremely dense vine-shrub thicket in a tree-fall gap and could be accessed only by crawling on the ground. It was on top of the horizontal "roof" of the vine tangle, under the small overhanging branch of a 2.5-m tall broadleaf shrub that projected above the undergrowth. Estimated percent nest concealment from 1 m was 20% above, 90% below, 70% north, 80% east, 10% south, and 0% west. Fresh eggshell fragments, as well as the continued nearby presence of both female and male Chat-tanagers suggested the nest had been recently depredated and it was collected at this time.

The nest was a bulky, coarsely-constructed, partially-domed structure with a west-facing side entrance that covered two-thirds of the nest cup. The exterior consisted of small woody stems 2–4.5 mm in diameter, robust herbaceous stems, peeled coarse exterior sheathing of herbaceous stems, vine tendrils, moss, and foliose lichens. About 40% of the outer layer was covered with the entire leaves of at least three broadleaf tree or shrub species. The inner cup was lined primarily with fine herbaceous stems and leaf fragments. The exterior diameter from back to the bottom rim of the entrance was 21.5 cm, from back to the entrance's top rim 14.5 cm, and from side to side 23.5 cm. The nest cup measured 13.1 cm from front to back, 11.1 cm from side to side, and 5.1 cm from back to the top edge of the entrance. The overall nest height was 13.1 cm.

A second nest of this species was discovered on 9 June 2004 by RKN and LGW when an adult flushed from close range. The nest was in a small clearing (~5 m diameter) within dense, mature broadleaf forest, 3 m from an actively-used foot trail. The nest was 1.1 m above ground on the eastern side of the lower trunk of a hardwood "ozua" (*Pimenta ozua*) tree. The nest tree was 13 m tall with its lower canopy 7.5 m above ground and a diameter at breast height of 19.7 cm. The nest was against the trunk and supported beneath by a collection of vines with two main stems (4.0 and 3.0 mm diameter) interwoven with the top of the nest, two main stems on the bottom of the nest (10.0 and 5.0 mm diameter), and several smaller stems 0.3–1.0 mm in diameter touching the side of the nest. Estimated vegetation concealment



FIG. 1. Western Chat-tanager nest with eggs, June 2004. Photograph by L. G. Woolaver.

for the nest from a distance of 1 m was 0% overhead, 90% below, 95% north, 10% east, 20% south, and 85% west. This cover was provided by the tree trunk and surrounding tangle of vine stems.

This nest also was a large, bulky structure, roughly oval in shape (Fig. 1). The nest cup was partially covered by a roof, creating a south-facing entrance 8.7 cm high and 8.2 cm wide. The exterior was composed of moss and lichens interwoven with twigs and whole herbaceous stalks from 1 to 5.5 mm diameter, stripped sheathing of herbaceous stems, dried leaf fragments of broadleaf species, and fragments of dried bromeliad leaves. The inner cup was lined with fine twigs and herbaceous stems, dried leaf fragments, lichen, moss, and a few adult body feathers. The exterior nest dimensions were 28.5 cm from front to back, 27.0 cm from side to side, and 26.0 cm from top to bottom. The nest cup measured 9.1 cm from front to back, 7.7 cm from side to side,

and 5.5 cm in depth. The nest cup height from the roof to the bottom was 14.3 cm.

The nest contained two eggs when discovered on 9 June. The eggs had pale blue background coloration and irregular light brown to dark brown speckling and mottling (Fig. 1). The eggs measured 27.8×18.7 and 28.9×18.8 mm and hatched on 19 and 20 June, respectively. No eggshells were found in the nest, suggesting the adults had removed them. The nestlings were dark pink with whitish bills and gapes, and covered with long, fine, black down. The nestlings were last confirmed alive at 1515 hrs EST on 25 June and both were missing from the nest at 0558 hrs on 26 June. The nest was damaged, suggesting depredation and it was collected on this date.

Observations on adult behavior at this nest were recorded by EMF from a photographic blind during 5 hrs on 20 June, shortly after the eggs hatched. The smaller of the two adults was banded and presumed to be the female, based



FIG. 2. Hispaniolan Highland-tanager nest with egg, June 2004. Photograph by E. M. Fernández.

on brooding behavior. The nestlings were brooded for 10–16 min periods each hour during which the female faced the nest entrance. The male fed the female a small white grub during one brooding session and provided her with small arthropods on several occasions while she was foraging near the nest. Both adults fed the chicks, but the male's feeding visits were infrequent and sporadic. The female fed the nestlings at 15–20-min intervals when not brooding. Each feeding bout consisted of 4–5 consecutive flights to the nest during which the female approached using a consistent pattern of perches. Her vocalizations changed from a short, two note “*chip-chip*” while foraging to an even “*tick, tick, tick, tick . . .*” as she approached the nest. The female was twice observed removing fecal pellets from the nest, although it was unclear whether she ate these or carried them away. The male sang for 10–15

min bouts each hour from different perches, but within 10 m of the nest.

Hispaniolan Highland-tanager.—Pablo Díaz found a nest of this species on 27 June 2004 containing one egg and one nestling that appeared close to fledging. The nest was in a dense vine tangle 2.5 m above ground. The vine thicket reached a height of 4.5 m and was in the understory of a closed-canopy broadleaf forest. Estimated percent nest cover from 1 m was 70% overhead, 70% north, 20% east, 60% south, and 70% west.

The nest was an open, cup-shaped structure (Fig. 2). The nest's exterior was composed of moss, small herbaceous stems, broadleaf leaf fragments, lichens, and other plant fibers. Its exterior cup was lined with fine, hairlike plant fibers and small numbers of herbaceous stems <1 mm in diameter. The exterior nest diameter was 10.5 × 7.9 cm, the nest cup diameter

was 5.6×5.2 cm, and the interior depth was 3.1 cm. The nest height was 5.5 cm. The single egg was oval in shape, pale greenish-white in background coloration, and faintly marked with reddish brown blotches and scrawls (Fig. 2). No measurements were obtained and the egg subsequently disappeared. The nestling fledged on 28 June.

The juvenal plumage, previously undescribed, was documented through photographs taken by EMF. The head and nape were brownish-gray, whereas the remaining upperparts were grayish tinged with olive-brown. The emerging flight feathers appeared dark grayish, the secondaries were edged greenish orange-brown proximally, and the greater coverts were predominantly greenish orange-brown. The underparts were a smudgy off-white with some brownish tones. The bill was grayish-flesh, the legs pale grayish, and the eye dark brownish.

DISCUSSION

Confirmed descriptions of the nests of the Western Chat-tanager or Hispaniolan Highland-tanager have not been published prior to this paper. Bond (1943:122) reported a possible Chat-tanager nest from the Massif de la Selle range in Haiti: "A single nest, containing one addled egg (23.6×18.3 mm) . . . , probably pertained to this species. This nest (found on June 14) was situated in a fern about two feet above the ground, bordering a blackberry patch. There was a protesting pair of Chat Tanagers a few yards from the nest . . .". The timing of this discovery and the egg dimensions are similar to our data, but more substantive information is lacking.

Two descriptions of apparent Hispaniolan Highland-tanager nests from the early 1900s are less convincing. One was shown to Bond (1928) on 11 June 1928 from Morne La Selle in Haiti. Wetmore and Swales (1931:396) described the nest as "globular in shape, composed of moss and grasses, lined with grass stems and feathers, and placed in a bush five feet from the ground." It contained "two fresh eggs, which are plain, creamy white in color without markings". Bond (1928) reported the respective egg measurements as 21.6×15.5 and 21.7×15.5 mm. The second reputed nest was reported to Wetmore and Swales (1931:397) by local residents at an unspecified lo-

cation, and described as "oval with the entrance from beneath". It is unlikely that either of these two nests was that of a Hispaniolan Highland-tanager, based on our documentation of the Pueblo Viejo nest.

Our limited observations suggest the peak incubation period for Western Chat-tanagers occurs from mid-May to mid-June. Further evidence of this species' nesting phenology is provided by two mist-netted females with fully-developed incubation or brood patches. One was captured on 16 May 2002 and the second on 18 May 2003 (CCR, unpubl. data). Both encounters indicate that incubation was underway by mid-May. The Hispaniolan Highland-tanager fledging date of 27 June is later than the mean (\pm SD) fledging date of 1 June \pm 25.5 days for the ecologically similar Green-tailed Ground-tanager (*Microligea palustris*) at Pueblo Viejo ($n = 14$ nests; CCR and SCL, unpubl. data), but well within the range of expected variation.

The depredation of both Western Chat-tanager nests highlights the generally high rates ($\sim 50\%$) of nest predation in montane broadleaf forests of the Sierra de Bahoruco. Introduced predators, particularly feral cats (*Felis domesticus*), black (*Rattus rattus*) and Norway rats (*R. norvegicus*), appear to limit nest success of several endemic montane species, especially those which forage and nest near the ground. The remains of the 2004 Western Chat-tanager nest do not allow us to identify the predator(s), as the nest had been pulled from below and the bottom ripped apart, leading us to believe a mammal was responsible.

High elevation broadleaf forests are considered one of Hispaniola's most endangered habitats (Latta and Lorenzo 2000). Ten of the 15 endemic bird species considered endangered or threatened on the island are concentrated in montane forests (Latta et al. 2006). Understanding factors that limit populations of these species is crucial to implementing successful management and conservation practices. Our documentation of the first nests of Western Chat-tanager and Hispaniolan Highland-tanager contributes to an emerging base of information on the ecology of these two species, both of which are regarded at high risk of extinction.

ACKNOWLEDGMENTS

We thank Jesus Almonte, Nicolas Corona, Pablo Díaz, J. D. Lambert, Danilo Mejía, Vinicio Mejía, Marisabel Paulino, Andrea Townsend, and Jason Townsend for assistance with very challenging field work. Funding was provided by the Bay Foundation, National Geographic Society, Scott Neotropical Fund of the Lincoln Park Zoo, Wildlife Preservation Canada, and friends of the Vermont Institute of Natural Science. Authorization to conduct our work was provided by the Subsecretaría de Areas Protegidas and Departamento de Vida Silvestre, Dominican Republic. Constructive reviews of the manuscript were provided by W. J. Arendt and J. W. Wiley.

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The Wilson Journal of Ornithology 120(1):195–199, 2008

Foraging and Nesting of the 'Akikiki or Kaua'i Creeper (*Oreomystis bairdi*)

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ABSTRACT.—The 'Akikiki or Kaua'i Creeper (*Oreomystis bairdi*) is a rare, little-known Hawaiian honeycreeper endemic to the island of Kaua'i. Its range is contracting, the population is declining, and it is a can-

didate for listing under the U.S. Endangered Species Act. We report an instance of foraging by excavation observed on 22 May 2006, a behavior previously unknown in this species, and on parental behavior at two nests observed on 24 May 2006 and 27 May 2007, about which there is little previous information. Both parents brought food to the nest, the male provided food for the female, and the female also foraged independently. The nesting pair in 2007 had a juvenile from a previous nest, indicating the 'Akikiki will attempt to raise two broods. These observations are of limited extent, but even small facts can contribute to our understanding of the biology of the 'Akikiki and causes of its decline. *Received 1 February 2007. Accepted 16 June 2007.*

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The 'Akikiki or Kaua'i Creeper (*Oreomystis bairdi*) is a small forest bird in the Hawaiian honeycreeper subfamily (Drepanidinae: Fringillidae) endemic to the island of Kaua'i. It was once found throughout Kaua'i and was locally abundant in the Alaka'i and Koke'e areas into the early 1960s (Richardson and Bowles 1964). It has disappeared from much of the island and is now restricted to high elevation native forests in remote parts of the Alaka'i Plateau (USFWS 1984, Scott et al. 1986, Foster et al. 2004). Forest bird surveys have shown a decrease in distribution from 88 to 36 km² between 1970 and 2000 and a decline in estimated population from 6,832 ± 966 to 1,472 ± 680 birds over this period (Foster et al. 2004).

No field research has focused on the 'Akikiki and we assume the causes of this decline are those typical of other Hawaiian forest birds: diseases carried by non-native mosquitoes, degradation of native forest habitat by invasive non-native plants, browsing and rooting by feral ungulates, and nest predation by non-native rodents (Foster et al. 2000, Scott et al. 2001, USFWS 2006). The threat from mosquito-borne diseases may worsen as global warming allows mosquitoes to invade the highest, coldest parts of the island that once provided a refuge from disease (Benning et al. 2002). The 'Akikiki has been a candidate for listing under the U.S. Endangered Species Act since 1994 due to its small and declining population, restricted distribution, and a variety of threats (USFWS 2004). It is considered critically endangered by the International Union for the Conservation of Nature (IUCN 2006).

The 'Akikiki is one the least-known of all extant Hawaiian bird species. Only eight 'Akikiki nests are known and there is no information about nest success, parental care of nestlings, reproductive rates, survival of adults or juveniles, or movements (Eddinger 1972, Foster et al. 2000, USFWS 2006).

The objective of this paper is to report observations on foraging and nesting of the 'Akikiki from trips to the Alaka'i Wilderness Preserve from 22 to 24 May 2006 and 24 to 28 May 2007. The primary purpose of these trips was to conduct forest bird surveys and research on the critically-endangered Puaiohi or small Kaua'i Thrush (*Myadestes palmeri*). These observations on the 'Akikiki are of lim-

ited extent, but even small facts can contribute to our understanding of the biology of this species and causes of its decline.

OBSERVATIONS

On 22 May 2006, EAV observed a pair of 'Akikiki foraging in the forest canopy on a low ridge in the upper Halepa'akai drainage. The birds visited several trees and spent ~1 min foraging on branches and twigs of a small, partly dead 'olapa (*Cheirodendron trigynum*) tree. They appeared to be gleaning and probing for insects on the bark, but photographs of one of the birds revealed that it had also been excavating rotten wood from the center of a twig, presumably for insect larvae (Fig. 1). The freshly excavated area where the bird had been working could be identified by the pale color of the newly exposed wood. Two small pieces of wood were visible on the bird's bill. There also were areas of darker, more weathered wood on the same twig that appeared to be older excavations.

We discovered an 'Akikiki nest on 24 May 2006, ~12.5 m above ground level in a 14 m tall 'ohi'a (*Metrosideros polymorpha*) tree on a bank of Halepa'akai Stream. Our attention was drawn to the tree by songs and calls from the male and by the unusual amount of time spent in the tree by the pair. The nest was positioned in a fork where several epiphyte-encrusted branches ~1–3 cm in diameter diverged from a larger branch (Fig. 2). The composition of the nest could not be examined closely due to its height, but it appeared to be composed of moss, small pieces of bark, bits of lichen, and fine plant fibers (Fig. 2).

We observed the nest from 1045 to 1215 hrs HST and made notes about all activity. One individual, assumed to be the female based on its behavior, sat on the nest continuously and left the nest once for 20 min. The head of one nestling was visible just over the rim of the nest (Fig. 2). A second adult, assumed to be the male, fed the female twice on the nest and the female passed food to the nestling each time. The male also fed the female once ~10 m from the nest, after which she left the area, presumably to forage. The female fed the nestling upon her return. The male sang near the nest only once during the timed observation period, but sang more fre-



FIG. 1. 'Akikiki foraging by excavation on a dead twig of a 'ōlapa tree in the upper Halepa'akai drainage, Kaua'i, 22 May 2006. Note the pale color of freshly excavated wood between the birds's feet and the darker color of older, weathered excavations higher on the twig. Photograph by E. A. VanderWerf.

quently earlier in the day when we were occupied with other activities.

The nest tree was one of the larger trees in the area and was prominent in the forest canopy. It had many flowers and was visited often by other birds, including 'Apapane (*Himatione sanguinea*), Japanese White-eyes (*Zosterops japonicus*), and 'Anianiau (*Hemignathus parvus*). The female 'Akikiki tolerated the presence of these birds and did not react to them, even when they approached to within ~50 cm of the nest. No 'Akikiki other than the nesting pair were seen or heard in the vicinity of the nest.

On 27 May 2007, EAV found an 'Akikiki nest in construction on Mōhihi Ridge. The nesting pair was accompanied by a juvenile, indicating they were attempting to reneest. The nest was ~8 m above ground level in a 8.5 m tall 'ōhi'a tree. The exterior was composed largely of moss and appeared to be complete. One bird, assumed to be the female, brought fine plant fibers to the nest three times from 1410 to 1510 hrs HST and worked on the nest lining. A sec-

ond bird, assumed to be the male, followed the female closely on two of the visits and called near the nest. The male fed the female once ~20 m from the nest. During the feeding the female fluttered its wings and gave high-pitched twittering calls. The juvenile had pale spectacles typical of immature 'Akikiki, and had fluffy plumage and foraged clumsily, indicating it hatched earlier in the same season.

DISCUSSION

The nests we observed were similar to other reported 'Akikiki nests, but the nest found in 2006 was slightly higher above ground level and in a taller tree. Two 'Akikiki nests reported by Eddinger (1972) were on terminal branches 8.1 and 8.5 m above ground level in the crowns of non-blooming 'ōhi'a trees, two nests observed during the 2000 Kaua'i forest bird survey were also in 'ōhi'a trees, a nest observed in 1999 was 9 m above ground level in a 9.6 m 'ōhi'a tree (David Kuhn, cited in Foster et al. 2000), two other nests were 4 and 6 m above ground level in 'ōhi'a (Jim Denny,



FIG. 2. 'Akikiki nest in the crown of a 'ōhi'a tree in the upper Halepa'akai drainage, Kaua'i, 24 May 2006. The female's head is visible above the nest rim, and downy feathers on the head of a nestling are visible in front of the female. Photograph by E. A. VanderWerf.

cited in Foster et al. 2000), and a nest found in 2005 was 8 or 9 m above ground level in a 'ōhi'a (Brett Hartl, pers. comm.). The nests reported by Eddinger (1972) were composed primarily of moss. The nest observed in 1999 by David Kuhn had an exterior of moss and a rim and lining of strips of 'ōhi'a bark, plant rootlets, and other fine plant fibers. At least one of the nests observed by Jim Denny included 'ōlapa bark (Foster et al. 2000). The timing of the nesting attempt we observed in 2006 was within the March-June breeding season described by Foster et al. (2000). The nest observed in 2005 by Brett Hartl was under construction on 29 January, which is earlier than all other known nesting activity. The nest we observed in 2007 would fledge in July, if successful.

There is limited information about the breeding biology of the 'Akikiki. Nest construction is reported to be by the male and female (Eddinger 1972), and the male is reported to feed the female during nest construction (Foster et al. 2000). Incubation has been

observed by the female only, and Eddinger (1972) commented on the tenacity of the female to remain on the nest during incubation despite disturbance. One nest found by Eddinger (1972) contained a single egg and a second nest contained two nestlings. Our observations provide new information. Both male and female 'Akikiki brought food to the nest, although only the female was observed to brood and feed the nestling. The nestling was fed three times during 1.5 hrs of observation, twice with food provided by the male and once with food provided by the female. The male provided food for the female during brooding, and it is likely that such provisioning occurs throughout the nesting cycle. The female also foraged independently and the relative importance of male provisioning remains unknown. These behaviors are common to other Hawaiian honeycreepers (Lepson and Freed 1997, Lepson and Woodworth 2001, Pratt 2005). The nestling provisioning rate (2.0/hr) and relative contribution of each gender (67% by the male) were similar to those

in the Hawaii Creeper (3.7 provisionings/hr, 57% by the male) (VanderWerf 1998). The pair observed in 2007 was at least attempting to raise two broods in a season, which is unusual among insectivorous Hawaiian honeycreepers. The nesting season is longer than previously reported with activity beginning in January in some years and renesting attempts possibly continuing into July.

'Akikiki are reported to forage on trunks, branches, and twigs of live and dead trees, primarily 'ōhi'a and koa (*Acacia koa*), and occasionally in subcanopy shrubs (Foster et al. 2000). They feed on insects, insect larvae, and other arthropods that are taken by gleaning and probing from bark, crevices, and epiphytes (Foster et al. 2000). There are no previous reports of the excavating behavior that we observed. No other bird on Kaua'i is known to excavate in this manner and it is improbable the 'Akikiki was taking advantage of an excavation begun by another species. The medium-length bill of the 'Akikiki is generally believed to be adapted for gleaning and probing, but our observations indicate it can also be used for excavation. The presence of similar but older and weathered excavation patterns on the same twig suggests it had been excavated previously, perhaps by the same individual 'Akikiki. Excavation may be a more regular foraging behavior in the 'Akikiki than is currently realized.

ACKNOWLEDGMENTS

We thank T. R. Savre and D. L. Leonard for camaraderie in the field, Brett Hartl for information about the nest observed in 2005, D. L. Leonard, C. E. Braun, and two anonymous reviewers for comments that helped improve the manuscript, and the Hawai'i Division of Forestry and Wildlife for continuing support of the Kaua'i Forest Bird Recovery Project.

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