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## Nests and Nesting Behavior of Golden Swallow (*Tachycineta euchrysea*) in Abandoned Bauxite Mines in the Dominican Republic

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**ABSTRACT.**—Little information is available on nesting of Golden Swallow (*Tachycineta euchrysea*), a threatened species that occurs only on the island of Hispaniola. We report on six nests discovered and monitored in abandoned bauxite mines in the Sierra de Bahoruco of the Dominican Republic. Nests were in cavities of the vertical walls of these pit mines. Clutch sizes consisted of 2–4 eggs and the nestling stage lasted between 21 and 24 days with both parents provisioning the brood. Three of the six nests were depredated by introduced mammals. We compare our observations of Golden Swallow nesting success to nesting studies of congeneric swallows and emphasize the potential conservation importance of a nest box placement and monitoring program on Hispaniola. Received 3 January 2008. Accepted 6 May 2008.

The Golden Swallow (*Tachycineta euchrysea*) is a rare and poorly described species that occurs only on Hispaniola, the Greater Antillean island politically divided between Dominican Republic and Haiti. Historically, the range of Golden Swallow also included Jamaica, but it has not been reported there since 1989 and causes of this local extirpation are unknown (Raffaella et al. 1998). On Hispan-

iola, where populations have declined over the last 30 years, the species is increasingly restricted to isolated remnant patches of montane forest from 750 m elevation to the highest forested peaks (Birdlife International 2000, Keith et al. 2003, Latta et al. 2006). Golden Swallows appear to prefer Hispaniolan pine (*Pinus occidentalis*) and mixed pine-broadleaf forests, but occasionally forage over open agricultural areas and natural savannahs (JMT, pers. obs.). The species occurs in the Massif de la Hotte of Haiti, Sierra de Bahoruco/Massif de la Selle along the border between the two nations, and in Sierra de Neiba and Cordillera Central of the Dominican Republic (Keith et al. 2003).

The Golden Swallow is a cavity-nesting species, reported to occasionally nest in colonies (Dod 1992), but detailed descriptions of its nesting ecology are lacking. The species has been observed in the Cordillera Central nesting in cavities of *Cecropia schreberiana* with 12 nests reported in one stand of four trees during May 1975 (Dod 1992). Multiple adults were observed delivering insects to these nests but the author did not report cavity size, number of nestlings, or structure of the nest. Individuals in the Sierra de Bahoruco have been observed constructing nests in cavities of living and dead emergent snags of *Didymopanax tremulus*, at heights estimated to be 14–16 m (JMT, pers. obs.). Similar observations of individuals investigating cavities in emergent hardwoods and hardwood snags

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TABLE 1. Golden Swallow nest and nest-site characteristics in abandoned bauxite mines, Sierra de Bahoruco, Dominican Republic, 2004.

Characteristic	Nest 1	Nest 2	Nest 3	Nest 4	Nest 5	Nest 6	Mean $\pm$ SD
Cavity substrate	soil/rock	soil/rock	soil	rock	soil/rock	rock	
Height above ground (m)	2	2.7	0.3	3.5	5	5	3.1 $\pm$ 1.8
Depth of cavity (cm)	16	18	28.5		23.6		21.5 $\pm$ 5.7
Width of cavity (cm)	9	9.8	11.9		9.2		10.0 $\pm$ 1.3
Height of cavity (cm)	8	9.9	5.2		5.8		7.2 $\pm$ 2.2
Width of entrance (cm)	4	5.7	7.7		9.2		6.7 $\pm$ 2.3
Height of entrance (cm)	3	2.6	5.2		5.8		4.2 $\pm$ 1.6
Elevation (m)	1,092	1,424	1,306	1,306	1,424	1,395	1,325 $\pm$ 126
Direction of exposure (°)	340	80	210	32	254	172	181 $\pm$ 113

have been made in the Sierra de Neiba and Massif de la Hotte (Rimmer et al. 2004, 2005). These cavities are often originally excavated by the endemic Hispaniolan Woodpecker (*Melanerpes striatus*) (Bond 1943). Additionally, there are reports of nesting in snags of Hispaniolan pine, especially in recently burned stands (E. M. Fernandez, pers. comm.); in caves (Fernandez and Keith 2003); and under the eaves of houses (Bond 1943).

We report six nests of Golden Swallows found in 2004 while conducting field work on other resident species. These nests occurred in abandoned bauxite pit mines surrounded by pine forest between 1,000 and 1,425 m in the Sierra de Bahoruco (18° 07' N, 71° 33' W). Pits were generally rounded with a diameter of ~200–500 m and vertical walls that extended 5–35 m below the natural surface of the land. Some forest regeneration is occurring in and around these pits with scattered Hispaniolan pines ranging from 2 to 5 m height and up to 15 cm diameter at breast height. The mines were created with heavy machinery between 1952 and 1982, and were abandoned in 1985. There are multiple earthen depressions and rock-pile crevices along the walls of these pits that provide cavity spaces for nest construction.

#### OBSERVATIONS

*Overall Phenology.*—Observations of Golden Swallow nesting activity occurred between early February and 25 July 2004. Pairs of swallows were observed investigating cavities in pit mines and in snags in early February. Nest construction was observed in pit mines on 5 May (entering with pine needles) and in cavities of emergent hardwood species

on 10 May (entering with pine needles) and on 16 May (entering with moss). Between 8 May and 25 July we discovered and monitored six active Golden Swallow nests in pit mine habitat. One of the observed nests was depredated on 9 May and an embryo recovered from an intact egg was estimated to be 2–4 days old. Ranges of hatch dates calculated for three of these nests were 25–27 May, 30–31 May and 3 June. Hatch dates for the remaining two nests were estimated to be within 15–30 June and 20–28 June. It is not known if these later nests were re-nests or if Golden Swallows nest asynchronously. Fledging dates for the three successful nests were 17 June, 19 July, and 22 July.

*Physical Placement of Nests.*—The observed nests were constructed deep within the mining pits and occurred within 5 m of the floor of the pits (Table 1). Nests were constructed in cavities along the vertical walls where rocks had tumbled and formed layers of crevices and openings. The inner walls and ceilings of cavities consisted of limestone boulders while the floors of the cavities were platforms of soil and rock. The soil in this area is a red, bauxite-rich clay with a dry, fine layer at the surface, and all incubating individuals had red-stained ventral body feathers from contact with this soil.

Four of the six nest cavities were accessible for interior measurement and had mean height of 7.2 cm, mean width of 10.0 cm, and mean depth of 21.5 cm (Table 1). Two of the four nest cavities had openings narrower than the interior cavity height with small triangular entrance holes measuring 4.0–5.7 cm at the base and 1.0–2.0 cm at the apex of the triangular openings.

TABLE 2. Incubation and provisioning observations at Golden Swallow nests in abandoned bauxite mines, Sierra de Bahoruco, Dominican Republic, 2004.

Nest #	Incubation		Feeding	
	# min incubating/ # min observed	Mean $\pm$ SD duration of incubation period (min)	# min observed	Mean $\pm$ SD # provisionings/hr
1	82/136	11.3 $\pm$ 3.9	b	
2	234/426	5.6 $\pm$ 3.3	c	
3	167/397	7.6 $\pm$ 3.0	221 <sup>d</sup>	11.4 $\pm$ 1.5
4	a		91 <sup>e</sup>	11.9
5	a		390 <sup>f</sup>	12.5 $\pm$ 4.2
6	74/120	8.2 $\pm$ 3.1	c	

<sup>a</sup> Discovered post-hatching.

<sup>b</sup> Depredated during incubation stage.

<sup>c</sup> No data collected during provisioning.

<sup>d</sup> Data collected over 4 days between nestling days 2 and 10.

<sup>e</sup> Data collected on 1 day = nestling day 6.

<sup>f</sup> Data collected over 5 days between nestling days 8 and 16.

**Nest Materials.**—One of the six nests observed was removed and collected intact after a depredation event. This nest was oval in shape to accommodate the shape of the cavity and measured 15  $\times$  10 cm. The long end of the oval nest was from the front to the back of the nest cavity. Nest structure consisted primarily of dry pine needles from Hispaniolan pines. These needles were interlaid to form the structural body of the nest and also to level any low points in the earthen floor of the cavity. The inner lining of the nest cup was a tightly woven amalgam of dry hanging moss (40–45% of total material), cotton-like plant material (40–45%), body feathers ranging from 1 to 4 cm in length and oriented with quills buried in the plant material (~5%), woven pine needles (~5%), and flakes of bark (<1%). Golden Swallows were frequently observed aerially collecting moss from hanging branches of Hispaniolan pines. One solitary individual was observed repeatedly feather-dropping outside of a nest cavity before entering the cavity and apparently depositing the feather.

**Eggs and Clutch Size.**—Clutch size was two to four eggs (2 eggs:  $n = 2$ ; 3 eggs:  $n = 2$ ; 4 eggs:  $n = 1$ ; at least 2 eggs [observed after depredation]:  $n = 1$ ). The natural color of eggs was difficult to ascertain because all those observed appeared to have been stained with the same red soil that stained the body feathers of the incubating adult. Natural egg color appeared to be white to creamy-white with minimal spotting. One egg, recovered intact from a depredated nest, was 18.8 mm in

length  $\times$  12.8 mm in width at its widest point, smaller than the mean egg size reported for a Caribbean congener, Bahama Swallow (*Tachycineta cyaneoviridis*) (19.4 mm length  $\times$  13.9 mm width) (Allen 1996).

**Parental Behavior.**—Nest observations took place on clear, rain-free days between 0900 and 1500 hrs at a distance from the nest of at least 100 m. All observations were by JMT from a position considered to be hidden from view of the birds where he remained stationary for the duration of the observation (mean duration of observation periods = 76 min, range = 32 – 136 min).

Nesting pairs were dispersed throughout mine habitat and there was no evidence of overlapping territories, communal breeding or coloniality. Four of the six nests were observed during the incubation period (Table 2). Apparently, only one member of the pair incubates, based upon observations of the red, soil-stained ventral body feathers of the entering and exiting individual, and the clean, white body feathers of the other individual observed in the area, but not in the nest cavity. The individual with clean, white body feathers frequently circled within 20 m of the nest cavity vocalizing loudly in the minutes before the red-stained individual exited the cavity, and then foraged with the red-stained individual. Incubating individuals spent 52% of their observed activity on the nest.

Provisioning of young was observed at three of the six nests (Table 2). Both members of the pair provisioned nestlings and were observed removing fecal sacks. We could not as-

certain if brooding behavior was shared between the male and female because the feathers of both pair members became soil-stained during the nestling period. The mean provisioning rate at the three observed nests, each with two nestlings, was 11.9/hr (SD = 0.6).

*Time to Fledging and Nesting Success.*—Three of the six monitored nests successfully fledged young and three were depredated. The three successful nests hatched and fledged different numbers of young: one fledgling from four eggs, two fledglings from two eggs, and three fledglings from three eggs. Young fledged at 21–24 days of age at two of the three successful nests, based on known hatch dates, within a range of 1 to 3 days; at the third nest, hatch date was only known within a range of 15 days. The three unsuccessful nests were found with disturbed nest cups and the near-complete feather sets of an adult Golden Swallow strewn within and immediately around the cavity area. We assume the incubating or brooding individual was killed during each depredation event.

#### DISCUSSION

The rate of nest depredation (50%) was higher than reported for other congeners. Depredation was reported for two of eight nests (25%) of Mangrove Swallows (*Tachycineta albilinea*) in Panama (Dyrz 1984) but was not reported as a cause of failure in 10 nests of Bahama Swallows in Grand Bahama (Allen 1996) nor in 128 nests of White-rumped Swallows (*T. leucorrhoa*) in Argentina (Massoni et al. 2007). Nesting success for 3,458 nests of Tree Swallows (*T. bicolor*) in 10 eastern North American populations was 78.8% and nest predation was not reported as a significant cause of failure (Robertson et al. 1992). Both White-rumped and Tree swallows make extensive use of nest boxes which may be considered less vulnerable to predators than natural cavities.

Potential mammalian nest predators on Hispaniola include Black rats (*Rattus rattus*), Norway rats (*R. norvegicus*), feral cats (*Felis catus*), and Indian mongoose (*Herpestes javanicus*), all invasive species that have been introduced within the last 500 years. An Indian mongoose was observed entering the nest cavity at one Golden Swallow nest within 12 hrs of nest predation, apparently in an attempt

to extract the remaining egg in the far depths of the cavity (Townsend 2006). The Indian mongoose is known to be expanding in population on Hispaniola (Horst et al. 2001), and is capable of easily accessing the narrow cavities chosen by Golden Swallows. Placement of nests on or near the ground in open pit mine areas may leave Golden Swallows especially vulnerable to predation by mammalian predators. It is unknown if Golden Swallows nesting in cavities of snags are exposed to high rates of predation, but rats on Hispaniola are known to be highly arboreal and have depredated nests of other resident cavity nesting species (JMT, pers. obs.). Future detailed and more extensive studies should focus on the breeding biology of Golden Swallows in all available habitats to examine nest predation and to place this species' breeding biology in the broader ecological context of a genus that spans much of the Americas.

That Golden Swallows are nesting in mines abandoned within the last 25 years attests to the species' willingness to explore novel habitats. A network of well-placed nest boxes with proper predator protection could be a key component to this species' continued existence. Mangrove, Bahama, and White-rumped swallows have all recently been observed nesting in artificial nest boxes and gourds (Dyrz 1984, Allen 1996, Massoni et al. 2007). However, nest boxes randomly placed in pine forest and mixed pine-broadleaf habitats of Hispaniola have not been occupied (JMT, pers. obs.). A more focused nest-box placement effort, possibly concentrating on the open mining areas, may result in greater success. A general program of nest box construction, focused nest box placement, intensive monitoring, and predator control could provide a wealth of data on this declining species. The proposed program could also be the basis for potential reintroduction of Golden Swallows into appropriate habitat in Jamaica.

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## Nest, Nestling Care, and Breeding Season of the Spangled Cotinga (*Cotinga cayana*) in French Guiana

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**ABSTRACT.**—I report a nest, nestling care, and the breeding season of the Spangled Cotinga (*Cotinga cayana*) near Saül, French Guiana. The open cup nest was found on 20 October 2007 with a 15–20 days old nestling, ~12 m above ground in a yellow mombin tree (*Spondias mombin*). Nest activities were followed during 4 days, from dawn to dark. The nestling's plumage had a scaled color pattern like that of the female, but was paler gray. The female left the nest between 0600 and 0630 hrs in the morning, and provisioned the nestling 6–8 times a day. Food items delivered to the nestling were mainly bluish to blackish fruits, ~6–7

mm in diameter, but also included a ~6 cm cricket (Orthoptera) and a ~10 cm lizard. The female arrived for a last provisioning between 1630 and 1710 hrs, after which she stayed with the nestling until morning. This and other records of breeding Spangled Cotingas suggest that nesting coincides with the dry season. Received 24 January 2008. Accepted 26 May 2008.

The seven species of blue cotingas in the genus *Cotinga* form a distinct group within the Cotingidae; little is known about their diet, foraging behavior, vocalizations, displays, reproduction, and timing of breeding (Snow

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