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Nesting Biology, Distribution, and Population Estimate of the Grenada Hook-billed Kite *Chondrohierax uncinatus mirus*

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The Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus* Friedmann) is endemic to Grenada, a small (310 km^2) and southernmost island (12N, 61W) of the Lesser Antilles (Blockstein, 1988). This kite was considered extinct at one time (King, 1979) but is currently regarded as endangered (del Hoyo et al., 1994). Blockstein (1988) listed all the published records for this bird, which include only two reports over wet forest; one north of Grand Etang (Bond, 1961) and one near Morne Fedon (600 m) in 1971 (Smith and Temple, 1982). The most recent surveys concentrated on the drier southwest peninsula and the north-east tip of the island and gave a total estimated population of 15-30 birds (Blockstein, 1988). Blockstein (1991) located approximately half as many kites in December 1989 and January 1990 in roughly equal search time. In June 1980, Smith and Temple saw at least eight birds in Grand Anse, Beaton, and other areas of the southern xeric woodlands; they also described aspects of the kites' feeding behavior and located a pair building a nest (Smith and Temple 1982). Herein we estimate the distribution and population of kites based on our sightings in February and August 2000, and present the first information on nests, nesting behavior, and diet.

From 22-28 February 2000, we searched for Hook-billed Kites during 63.5 h and covered 487 km by car. We traversed at least once nearly every road in the southern half of the island and visited selected areas in the north. From 2-10 August 2000, we searched during 50 h, revisited all areas where kites were seen in February, and conducted 36 h of nest observations. We used 8-10 × 35-45 binoculars, and 60 and 82 mm spotting scopes for identifying distant kites and making nest observations. Many observations were of kites in distant soaring flight; these birds were separated from the common Broad-winged Hawk (*Buteo platypterus*) through a spotting scope on the basis of flight profile and behavior. Individual birds were identified by feather condition (broken, worn, or decayed), molt gaps (primaries, secondaries and rectrices), and sexually dimorphic plumage. All kites seen in February and most seen in August had feather wear and molt gaps. Based on the quality of kite habitat remaining on the island the, habitat without access, and our limited survey time, we estimated the current population of

this bird at more than double the number of confirmed observations.

All map references refer to the 1988 Ordinance Survey maps, Grenada South (1:25,000) and North (1:25,000). Nest locations were measured with a hand-held GPS. Nest tree diameter was measured to the nearest cm and nest height was estimated to the nearest m. Snail shells were collected below the nest and identified to species by Fred Thompson (Florida Museum of Natural History).

February Observations

During February we made 19 sightings representing an estimated 15 individual kites (Table 1). A total of 15 observations occurred in the Southwest Region, 2 in the Southwest Central Region, 1 in the West Central Region, and 1 in the North Eastern Region of the island. Of the 19 sightings, 10 were associated with southwest xeric habitat, 3 with mixed species woodland (including introduced trees), 3 with wet forest, 2 with mixed xeric woodland, and 1 with the northeast xeric forest. Kites often soared directly over feeding or prospective nesting sites. Habitats ranged in elevation from 25-550 m (mean- 147.5 m ± 47.4 (SE), median-72.6 m, n = 14). Several kites soared to over 300 m and glided or descended out of view. No breeding activity was observed during February.

August Observations

During August, we confirmed the presence of at least 15 individuals, including 2 nesting pairs, 2 probable nesting pairs, 1 pair without nesting activity, at least 5 solitary individuals away from nesting territories, and 1 bird in juvenile plumage (Table 1).

On 2 August at 11:00 h we located a nest with a 14-21 day old nestling on a north-west facing slope NE of Morne Rouge (50 m elevation; 12°01'N, 061°45'W). Observations at this nest totaled 30.9 h over seven observation periods. The nest was approximately 40 cm in diameter and 10-15 cm deep; it was loosely-built with about 100 dry twigs each measuring about 5 mm in diameter. The nest was supported by two 1-3 cm diameter branches and was situated 3 m from the center of the tree on a 12 cm diameter branch. The nest was 15 m above ground on a 23 m *Ceiba pentandra* (Gaertner) tree with a 67.5 cm dbh trunk. Neither adult delivered nest material during the nestling period, but both birds foraged 50-400 m from the tree along the south and north slope.

We found a second nest on 4 August near the Woodland Sugar factory (12°01'N, 061°44'W), 2.7 km northeast from the Morne Rouge nest. This was a platform nest built 17 m above ground in a 26 m *Erythrina micropteryx* (Poepp) tree with a 59.9 cm dbh. The nest was similar in size to the first one; it was easily accessible from the air and supported by two branches at a point 8 m from the center of the tree. Observations at this nest totaled 5.1 hr over three days. The male incubated for 132 min, the female for 209 min, and the nest was unattended for 53 min. Both sexes brought twigs collected 20-50 m from the nest tree.

Food habits

We recorded 156 prey items, predominantly at Mourne Rouge nest, of which 133 were identified to species. All prey items were snails belonging to *Drymaeus dominicus* (Reeve) 55.6 % (n=74) (small, thin, yellow arboreal species), *Orthalicus undatus* (Binney) 34.6 % (n=46) (large, 2-4 cm long, striped, conical arboreal species), and *Pleurodonte perplexa* (A. de Férussac) 9.8 % (n=13) (flat, granular terrestrial species). The 23 unidentified prey items were presumably snails of the smaller arboreal species. The male delivered 73 snails and the female delivered 83. Prey delivery averaged 4.7 ± 4.5 (SD) snails per hour. On 11 August the nest was observed continuously from 08:00 to 17:45 (near dusk). Feeding stopped at 16:54 and during this period the nestling was fed 28 times (46.4 % by the male, 53.6 % by the female). The male and the female spent respectively 43.8 % and 33.1 % of the time resting in the nesting tree.

In Guatemala, Marroquin et al. (1992) recorded the mainland kite subspecies feeding on arboreal snails (88 %), lizards (7.5 %) and unidentified prey (4.5 %). Grenada Hook-billed Kites took predominantly two arboreal species, *Drymaeus dominicus* and *Orthalicus undatus*, that to the same genera taken by kites in Guatemala. According to Smith and Temple (1982), the diet of the Grenada Hook-billed Kite during June consisted of the arboreal snails *Bulimulus wiebesi* and *Endolichotus grenadensis*. During our observations in August we recorded kites feeding on three native snails not observed by Smith and Temple (1982). This difference may indicate a seasonal shift from the dry season, when many snail species are dormant, to the wet season when snails become abundant. In July 1987, Blockstein (1988) found kites feeding on two snails; a "small-spired species" and a "a larger brown-banded snail similar to *Orthalicus ponderosus*" (apparently the common *O. undatus*). We watched kites seaching for snails in habitats ranging from dense shrubbery 1 m from the ground to flower buds on the tips of branches. The terrestrial snail *Pleurodonte perplexa*, which was taken infrequently, was common on the trunk of the Morne Rouge nest tree at <4 m on August 10, 2000.

Distribution and population

The earliest report of the Grenada Hook-billed Kite described the bird as "not numerous" and mostly found near the seacoast (Wells, 1886). Almost all records have come from the south-west and south coast, or from a small xeric area around Levera Pond in the north-east (Blockstein, 1988, 1991). There are few records from 1886 to 1974 and the survey by Lack and Lack (1973) did not mention finding this bird.

From 22-29 June 1980, Smith and Temple (1982) searched the southern xeric woodlands and estimated the kite population to consist of at least eight individuals. Blockstein (1988) spent 262 hours searching for kites and the endangered Grenada Dove (*Leptotila wellsi*) in uninhabited areas of the southern part of the island and observed 6-13 kites, from which he estimated the total population on Grenada to be 15-30

TABLE 1. Grenada Hook-billed Kite (*Chondrohierax uncinatus mirus*) sightings during 22-28 February and 2-11 August 2000.

Site	February	Site	August
Southwest Xeric Woodland	Date, time and observation	**Southwest Xeric Woodland**	Date, time and observation
Mt. Tout	24 Feb at 0725 h one kite (probable female)	Morne Rouge	2 Aug at 1100 h one nesting pair
Mt. Hartman	25 Feb at 0750 h one male soars and disappears towards Woodlands Estate	Mt. Tout	2 Aug at 1130 h one pair
Woodlands Estate	25 Feb at 0720 h one female perched and then soars	Woodland Estate (sugar factory)	4 Aug at 1000 h one nesting pair
Woodlands Estate	25 Feb at 0805 h one male soars with female (possible male from 0750 h)	Woodlands Estate (east of golf course)	5 Aug at 1130 h one kite flying
Woodlands Estate	25 Feb at 1710 h a pair soars up (female not same as 0720 h)	Mt. Tout	7 Aug at 0830 h one pair (possible pair from 2 Aug) and one juvenile
Marian	27 February at 0920 h two males interact in territory dispute?	Woodlands Estate (ease of golf course)	7 Aug at 1105 h one kite passes by
Mt. Hartman	27 February at 1500 h one female forages and one male passes by	Woodlands Estate (east of golf course)	8 Aug 0800 h 5 sightings of 3 possible kites
		Woodlands Estate	8 Aug 1300 h male flying
St. Georges Mixed Woodland		**St. Georges Mixed Woodland**	
Botanical Gardens	22 February at 1430 h one female soars up	Richmond Hill	8 Aug 1200 h one possible pair
Richmond Hill	27 February at 1105 h one female and male acting as a pair		
Northeast Xeric Woodland		**Northeast Xeric Woodland**	
Levera Hill	23 Feb at 1530 h one kite flying SE		
Southwest Central Wet Forest		**Southwest Central Wet Forest**	
Bon Accord Estate	24 Feb at 1050 h one kite disappear towards Mt. Maitland	Mt. Parnassus Estate	9 Aug at 1000 h one probable pair
Mt. Parnassus Estate	24 Feb at 1230 h one kite (possible same as 1050 h sighting)		
North Central Region		**North Central Region**	
Palmiste Lake	28 Feb at 1220 one male soars and met by another in kite in distance		
Total	**15 individuals**		**15 individuals**

birds. From 13 December 1989 to 28 January 1990, Blockstein (1991) spent 3.5 weeks searching in the lowland dry scrub woods of the northeast, west coast, and southwest, and opportunistically collected data on kites. He made 17 sightings totaling a minimum of four individuals at Mt. Hartman National Park In February 2000, we observed three individuals at Mt. Hartman and no individuals during August 2000, suggesting that seasonality and breeding period may be the main explanation for the similar observations.

We concur with Smith and Temple (1981) and Blockstein (1988, 1991) that kite density is highest in

the comparatively drier southwestern region, but unlike the Grenada Dove, which is entirely restricted to two areas of dense secondary-scrub woodlands, the kite shows a preference for more mesic woodland with more mature trees.

The Grenada Hook-billed Kite tolerates habitat that contains a mixture of native and introduced trees. The steep wooded slopes around St. Georges, with stands of tall mature trees, seem to be preferred nesting locations. The most important discovery in this study was of several kites utilizing rainforest habitat away from the southwestern xeric woodlands. The birds seen on forested slopes of Mt. Parnassus in February and August, and in rainforest near Palmiste Lake on the west coast in February represent entirely new localities for the species. By confirming that kites use rainforest and forest slopes up to 400 m, we suggest that there are many other areas of suitable habitat in Grenada. We did not find kites in the higher rain (cloud) forest. We estimate the current population of *C. ucinatus mirus* in Grenada to be at least 40 individuals but suspect that an extensive survey will produce a greater kite density and broader distribution.

Nesting activity

Assuming an incubation period of 35 days (del Hoyo et al., 1994), nest building and egg laying for the two nests studied in 2000 took place between mid June to late July. This is the start of the nesting season recorded by Smith and Temple (1982) for one pair of kites constructing a nest on 26 June 1980. Hatching is therefore timed to coincide with the end of the dry season and start of the wet season, when when snails are most abundant. The wet season in Grenada spans late July to October.

The 16 m average nest height was higher than the 5-7 m recorded by Smith (1982) for Hook-billed Kites in Mexico, but is considerably lower than the mean (25.8 m) for four nests of the nominate race in Guatemala (Marroquin et al., 1992). This range of nest heights relates to the stature of the forests-xeric flat forest in Mexico, xeric/moist slopes in Grenada, and semi-dry forests in Guatemala.

We are optimistic about the survival of the Grenada Hook-billed Kite and believe that the species is more common than previously thought. Perhaps these birds may be adaptable to a limited degree to human-modified habitat. The nests in 1991 and 1995 (B. Rusk pers. comm.) were in the front yard of a home in a flamboyant tree (an introduced species to the island). Kites need mature trees for nesting and woodlands for food resources, and the survival of this endangered insular kite will depend on the presence of adequate nesting and foraging habitat.

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