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THE MOUNTAIN GUAN (*PENELOPINA NIGRA*) IN THE SIERRA YALIJUX, GUATEMALA

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Resumen. – El Pajuil (*Penelopina nigra*) en la Sierra Yalijux, Guatemala. – La distribución del Pajuil está limitada a las montañas de Mesoamerica (sobre 900 m). La especie está presente desde el sur de México (Chiapas y Oaxaca) hasta el norte de Nicaragua, pero es probable que las poblaciones más grandes estén en Guatemala. El Pajuil es una especie considerada en bajo riesgo/cercana a ser amenazada ("Lower risk/near threatened", A1 cd + 2c) y está listada en CITES (Apéndice I); al parecer, su supervivencia es dependiente del bosque nublado primario. Se estudió una población del Pajuil en una cadena montañosa del centro de Guatemala (Chelemhá, Sierra Yalijux, Alta Verapaz) de Marzo a Julio de 2002, para analizar las preferencias de la especie en cuanto al hábitat. La mayoría de las observaciones (81.6%) fueron realizadas en áreas de bosque primario. Todos los juveniles fueron criados dentro de los límites del bosque. También se observó la reproducción y se siguió por lo menos a dos juveniles hasta el final del estudio en Septiembre de 2002.

Abstract. – The Mountain Guan (*Penelopina nigra*) is restricted in distribution to the Central American Highlands (above 900 m). The species occurs from the southern Mexican states of Chiapas and Oaxaca to northern Nicaragua, but the largest populations are assumed to survive in Guatemala. Listed as a "Lower risk/near threatened species" (A1 cd + 2c) and in CITES Appendix I, the Mountain Guan apparently is dependent for survival on primary cloud forest. A population of Mountain Guans in the northernmost Guatemalan mountain range (Chelemhá, Sierra Yalijux, Alta Verapaz) was studied from March to July 2002 to analyze the species' habitat preferences. Most observations (81.6%) were made in primary forest areas. All juveniles were raised within the forest boundaries. I also observed successful breeding and followed at least two juveniles until the end of the study in September 2002. *Accepted 6 May 2005.*

Key words: Conservation, Guatemala, Mountain Guan, *Penelopina nigra*, tropical montane cloud forest, habitat use.

INTRODUCTION

Biodiversity in the tropical belt is threatened (e.g., Pivello 1999, Sheil 2001, Paulsen 2003), and forest habitat loss is the major factor causing losses in species richness (e.g., Balmford 1995, IUCN 2000, Stattersfield & Capper 2000, Hughes *et al.* 2002). Deforestation is the major cause behind habitat destruction in Guatemala and all of Central America (Markussen 2003). Guatemala, a country with a large amount of highlands, has one of the highest annual deforestation rates in Central America with 1.7% per annum (FAO 2001, Markussen 2003).

Mountain Guan (*Penelopina nigra*) inhabits wet premontane and montane evergreen and pine-oak forests of subtropical and temperate zones (Land 1960, 1970; Peterson & Chalif 1973, Edwards 1998, Howell & Webb 1995) between 900 and 3150 m (Stotz *et al.* 1996) but occasionally can be found as

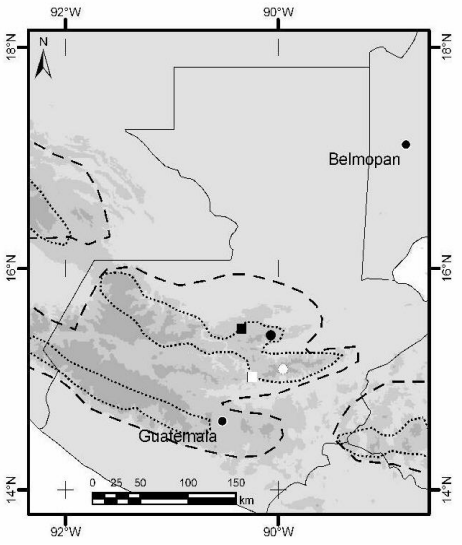

FIG. 1. Guatemala and sites mentioned in the text relevant to Mountain Guan (*Penelopina nigra*) and this study (black point: Chelemhá, white point: Albores plot, black square: Cobán, white square: Biotopo del Quetzal). Dotted line illustrates the presumed distribution of Mountain Guan in Guatemala and adjacent areas based on elevation (> 1000 m) and distribution of cloud forests (Landesbund für Vogelschutz 1990, Renner *et al.* 2005). Dashed lines indicate the distribution of Mountain Guans based on Howell & Webb (1995).

low as 250 m. The species is locally common, especially in Guatemala (Stotz *et al.* 1996, BirdLife International 2004). Previous studies have reported densities of 30 individuals/km², and the species may be more common than previously suggested (del Hoyo 1994, Vannini & Rockstroh 1997). The Mountain Guan is considered near threatened (Stattersfield & Capper 2000, BirdLife International 2004), by hunting pressure and habitat alteration (Andrle 1967, Howell & Webb 1995, BirdLife International 2004).

Here, I investigate the occurrence and habitat use of the Mountain Guan in an area of mixed primary cloud forest and secondary forest, and discuss the importance of primary forest for the species' future.

STUDY AREA AND METHODS

The study was conducted in a tropical cloud forest region in northern Guatemala (Fig. 1). A 102-ha study plot was established in the Sierra Yalijux (90°04'W, 15°23'N, 1980 to 2550 m), in which primary forest and secondary forest each covered 50% of the total area. The young secondary forest in the Sierra is regularly slashed and burned for agriculture, but young secondary forest within the study plot has not been burned for the 6 years prior to this study, and was characterized by vegetation up to 10 m in height. Human disturbance in the primary forest was limited to a small amount of timber extraction and minimal subsistence hunting for guans. However, timber extraction from natural forests and hunting is small scale and barely recognizable, e.g., I recorded one hunting incidence while two years in the region.

Standardized censuses were conducted during the species' breeding season from April to June. In primary and secondary forest, an existing trail system was used to count birds by means of regular transects in order to assess population densities for different habitats of the plot (Bibby *et al.* 1995, Krebs 1999, Gilbert *et al.* 2000). Standardized censuses were conducted three times during the breeding season of the Mountain Guan, once in April, once in May, and once in June 2002. All Mountain Guan individuals seen or heard along 3150 m of transects were mapped and, when possible, aged. Transects were separated in 25 m intervals and all records of the species within 100 m from transects were recorded. Juveniles are generally more brownish than the black adults (Land 1970, Howell & Webb 1995). It was possible to distinguish several individuals on occasion during audiovisual surveys. For instance, two (or more)

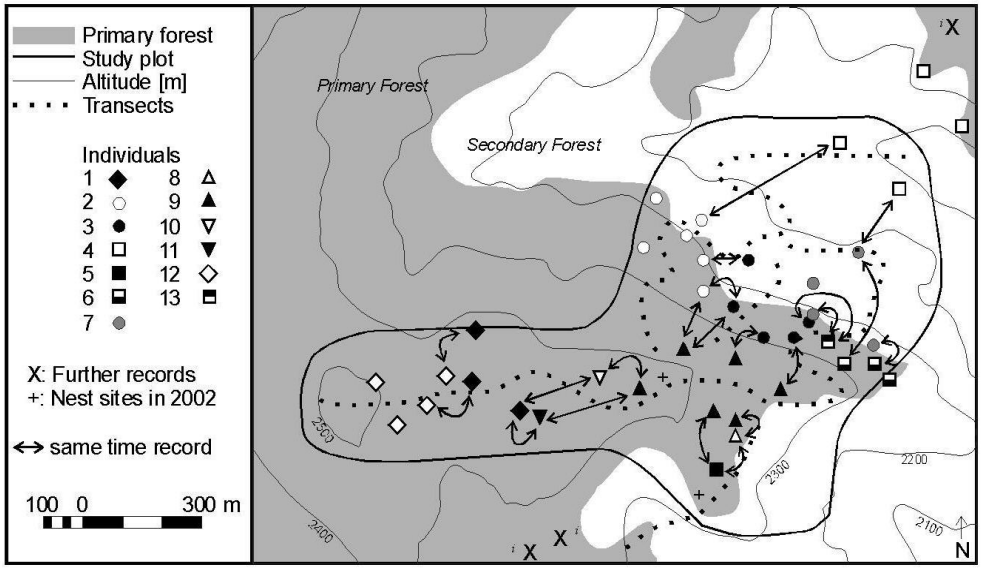

FIG. 2. Records and presumed individuals of *Penelopina nigra* in the Chelemhá Plot in 2002. Detections outside primary forest were exclusively made at solitary trees. Each symbol represents one displaying/calling adult and a record during the 2002 census. *i* represents incidental record outside transect counts.

simultaneous callings were considered as two (or more) individuals. Due to loud calls, audible from the forest border in open country and hills up to 450 m distant, and distinctive display behavior, as many as four individuals of the species could be mapped at the same time. The number of individuals was derived from the maximum number of observations per transect repetition. Critical for distinction between individuals was the simultaneously calling activity. However, numbers of individuals might be lower (see results/discussion for details). For a more detailed description of the study area and methods used, refer to Renner (2003) and Renner (2005).

To link observations of Mountain Guans to vegetation parameters, diameter at breast height (dbh), tree density and tree height of canopy and understory were recorded (dbh for understory tress > 10 cm). All parameters were measured (height estimated) at every 25 m along transects; tree density was measured as the distance from the transect point to the nearest understory/overstory tree to obtain a measure for the density of the vegetation. Tree height was estimated and the classes were set to 1–2, 2–5, 5–10, 10–15 m, etc.

RESULTS

Population estimate for Mountain Guans in the Chelemhá plot. In the 102-ha plot, 38 observations were made in 2002 (Fig. 2). In addition, two juveniles were observed at the SE side of the study plot at the end of the breeding period in September 2002. The minimum known population size for the site is four, based on simultaneous observation of four males displaying/calling at the same time. This happened once. However, there were several times when three individuals were recorded simultaneously.

Three additional observations of Mountain Guans were made in the vicinity of the

TABLE 1. Vegetation parameters in the Chelemhá Plot in 2002 for 145 measurements.

	Primary forest		Secondary forest		Test P[1]
	Mean	S.D.	Mean	S.D.	
Dbh overstory (cm)[2]	75.6	13.4	0.0[3]	0.0	< 0.01
Tree height overstory (m)	23.2	5.6	0.0	0.0	< 0.01
Density overstory trees (m)	278.3	74.7	0.0	0.0	< 0.01
Dbh understory (cm)	5.3	1.6	1.6	0.6	< 0.01
Tree height understory (m)	4.9	0.9	2.1	1.6	< 0.01
Density understory trees (m)	141.1	35.0	113.0	84.6	0.30

[1]Mann-Whitney *U*-test between parameters in primary forest and secondary forest.
[2]Dbh: Diameter at breast height (cm).
[3]0.0: No overstory/canopy present in secondary forest.

study plot. One individual was inhabiting a solitary 3-ha primary forest fragment, north-east of the study plot (indicated by a X in the upper most right corner of Fig. 2). Individuals were also observed south of the plot (Fig. 2). While conducting basic observations in the north-western vicinity of the study plot (between the plot border and the letters 'Primary Forest' in Fig. 2), no individuals were observed. This indicates a patchy distribution of the species.

Habitat use by Mountain Guan. The Mountain Guan was observed most times (81.6%) in primary forest (31 observations in primary forest part of the study plot and three additional observations in primary forest outside the study plot). Seven observations were made in secondary growth. Observations in secondary forest were in trees near the forest edge or large solitary trees (smaller than 8 m) within secondary vegetation. The solitary trees are remnants of the primary forest. The distribution of Mountain Guan individuals between the two vegetation types is not significantly different (*U*-test, $P = 0.15$).

Nests of Mountain Guan were detected two times in the 'canopy' of tree ferns (Cyatheaceae). These two tree fern specimens were comparatively small in stature (2.5 to 3.5 m tall). Tree ferns in Chelemhá can be 10 to 15 m in primary forests. Breeding success in these nests was not recorded. The juveniles observed on the plot were probably from other breeding pairs.

All six analyzed vegetation parameters – tree height, dbh, and tree density of both understory and overstory – are significantly different ($P > 0.01$) between primary forest and secondary forest (Table 1). The most obvious difference between the forest types is that secondary forest has no visible vegetation stratification and lacks an overstory. Vegetation parameters associated with occurrence of Mountain Guans are dense overstory and large dbh overstory trees (for both $R^2 \approx 0.45$, both $P = 0.08$, Fig. 3).

If Mountain Guan distribution is limited to cloud forest in Guatemala (≈ 1800 m and higher in Guatemala; Landesbund für Vogelschutz 1990), then the species' range is slightly different from that provided by Howell & Webb (1995) (Fig. 1). The Montagua Valley and the central highlands – especially the eastern highlands which are included in Mountain Guan distribution by Howell & Webb (1995) – has dry shrub and bush vegetation with desert like characters. Since Mountain Guans are also abundant below the montane cloud forest zone in primary forests (pine oak forests, compare Eisermann 2000), the range is

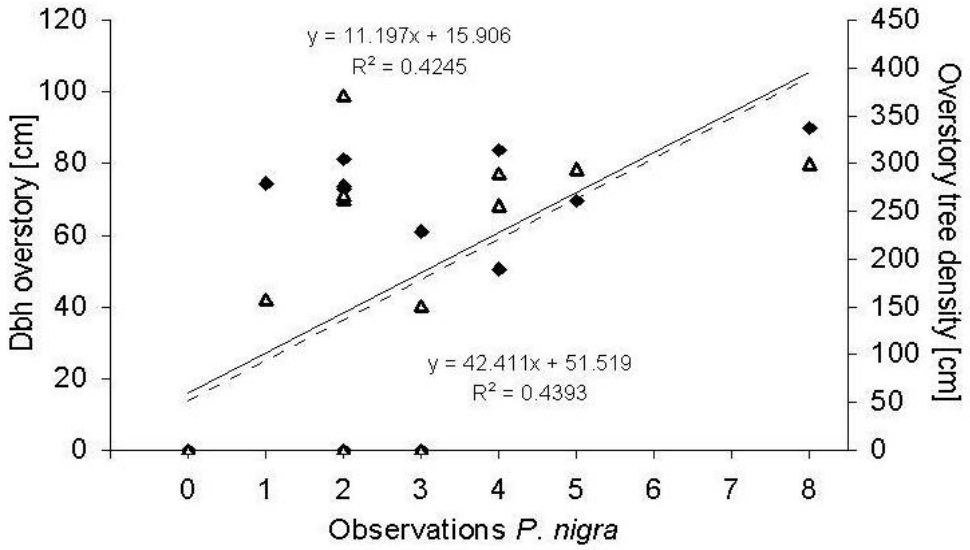

FIG. 3. Regression of observations of Mountain Guans (*Penelopina nigra*) with overstory diameter at breast height (dbh: square, solid line) and overstory tree density (triangle, dashed line) in the Chelemhá Plot.

somewhat larger than the cloud forests mapped in Fig. 1.

DISCUSSION

Deforestation in the Sierra Yalijux. Mountain Guan populations appear to depend on primary cloud forest (Howell & Webb 1995, Stotz *et al.* 1996) and therefore the populations' future is directly connected to deforestation. The mean annual deforestation rate in Guatemala is 1.7%; deforestation mainly is going on in the northern lowlands of El Petén in Guatemala (Markussen 2003). The mean deforestation rate in the study region is estimated to be somewhere between 0.5% and 1.0% (Markussen 2003, Voigt 2004). Assuming the worst case with an annual constant deforestation of approximately 55 ha (comparable to a deforestation rate of 1.0% in 2002) in the study region and 5500 ha of remaining primary forest in the Sierra Yalijux in 2002 (Markussen 2003, Voigt 2004), no primary forests will be left after the year 2102.

Population estimate for Mountain Guans in the Chelemhá plot. The 38 observations of Mountain Guan in the Chelemhá Plot can be used as basis to estimate the population size. Based on the assumption that the maximum number of observations made per transect counts represents the individuals of the plot, 13 individuals were present on the Chelemhá plot. However, this assumption is speculative since Mountain Guans have (1) a strongly biased sex ratio towards females, (2) most records suggest that the Mountain Guan is breeding not in pairs but units with generally less than five individuals per unit and polygyny is suspected but not securely proven so far, and (3) it is unclear whether or not females display also (del Hoyo 1994).

The observation of at least 4 ind./km² is slightly higher for Mountain Guans in Guatemala compared to other regions. Eisermann

(2000) reports 2.7 ind./km² in a study site located 12 km west of Chelemhá near the community of Caquipec. Other studies (Nájera 2004) observed < 2 ind./km² in Albores, Sierra de las Minas – a Biosphere Reserve 20 km south of Chelemhá, across the Río Polochic Valley. The Chelemhá Plot is separated from these sites by a deep valley (≈ 1200 m altitudinal difference) and by a gap in the forest. Dispersal and exchange of individuals between these widely-separated populations seems unlikely. The plot studied by Eisermann (2000) probably has connections to the next larger reserve (Reserva Mario Dary Rivera "Biotopo del Quetzal", Fig. 1). The Sierra Yalijux is connected with the Biotopo del Quetzal by old secondary forest of different age stages and pine re-forestation areas, which are only interrupted by streets and few patches of up to 10-ha large leather-leaf fern plantations (*Rumohra adiantiformis*). However, the primary forest continuum within the Sierra Yalijux is interrupted between Caquipec and Chelemhá by two larger gaps of agriculture (both are approximately 1 km wide) (Markussen & Renner 2005, Renner & Markussen 2005). Nevertheless, the regional population of the Highland Guan in Chelemhá is comparatively higher, densities of 30 ind./km² have been reported (Vannini & Rockstroh 1997, BirdLife International 2004). Large numbers might be derived from the species assembling during post-breeding. My observations in the study region apart from the study plot (in the area of the two X in the south of the study plot, Fig. 2) in December 2001 indicate that Mountain Guans assemble seasonally in groups with up to 10 individuals.

Guatemala seems to be the main stronghold for the survival of Mountain Guans (BirdLife International 2004). The situation is also good in Chiapas, south-west Mexico (Gómez de Silva *et al.* 1999, Peterson *et al.* 2003) where Mountain Guans are locally common in Chimalapas and El Triunfo but the areas are small and disjunctive, probably indicating diminished gene flow.

Habitat use by Mountain Guan. Affinity of the Mountain Guan to primary forest in Chelemhá is significant. Mountain Guans were only observed to reproduce in the primary forest part of the Chelemhá Plot. Secondary forest was to a far lesser extent used by the Mountain Guan in the Chelemhá Plot during census procedures. Eisermann (2000) concluded from his data in the Sierra Yalijux that Mountain Guan probably prefers both primary and old secondary forest (> 15 years) as breeding habitat. Young secondary forest or slash-and-burn agriculture is not suitable for breeding Mountain Guan (Eisermann 2000), since the breeding trees are absent here. Mountain Guans do not use plantations even when canopy for shading is left (del Hoyo 1994, Greenberg *et al.* 2000).

Conservation status. Findings in this study indicate that the conservation threat to Mountain Guans has been underestimated. Currently, the Highland Guan is listed as "near threatened." Additionally, the red list coding for the species is 'A 1cd + 2c' (BirdLife International 2004, IUCN 2001) indicating a decline of > 20%, and predicting further severe declines in the near future.

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