

## CHANGES IN ABUNDANCE OF CRESTED GUAN (*PENELOPE PURPURASCENS*) AND BLACK GUAN (*CHAMAEPETES UNICOLOR*) ALONG AN ALTITUDINAL GRADIENT IN COSTA RICA

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**Resumen.** – Cambios en la abundancia de la Pava Crestada (*Penelope purpurascens*) y la Pava Negra (*Chamaepetes unicolor*) a través de un gradiente altitudinal en Costa Rica. – Hice un monitoreo de la abundancia de la Pava Crestada (*Penelope purpurascens*) y de la Pava Negra (*Chamaepetes unicolor*) en tres diferentes elevaciones en la Cordillera de Tilarán, Costa Rica, durante 1998. Ambas especies fueron más abundantes a 1400 m s.n.m. (bosque lluvioso montano bajo) durante su época reproductiva. Después de la época reproductiva, su abundancia disminuyó a esa altitud y se incrementó a una menor elevación: 800 m (bosque lluvioso premontano). Además, la abundancia de la Pava Crestada se incrementó a 400 m (bosque húmedo tropical transición a premontano) durante la época no reproductiva. Estos cambios en abundancia coincidieron con el patrón de migración altitudinal que exhiben especies migratorias altitudinales bien confirmadas en la vertiente Caribe de Costa Rica, por lo que podrían reflejar que ambas especies de pavas son migratorias altitudinales.

**Abstract.** – I monitored the abundance of Crested (*Penelope purpurascens*) and Black (*Chamaepetes unicolor*) guans at three different elevations on the Caribbean slope of Cordillera de Tilarán, Costa Rica, during 1998. Both species were more abundant at 1400 m a.s.l. (lower montane rain forest) during their breeding season. After the breeding season, their abundance decreased at that altitude and increased at a lower elevation: 800 m (premontane rain forest). Also, Crested Guan abundance increased at 400 m (tropical wet forest transition to premontane) in the non-breeding season. These changes in abundance coincided with the pattern of altitudinal migration that well-confirmed altitudinal migrant species exhibit on the Caribbean slope of Costa Rica, and might reflect that both species of guans are altitudinal migrants. Accepted 8 September 2002.

**Key words:** Crested Guan, *Penelope purpurascens*, Black Guan, *Chamaepetes unicolor*, Tilarán, Monteverde, Costa Rica, altitudinal migration, altitudinal movements.

### INTRODUCTION

Crested (*Penelope purpurascens*) and Black (*Chamaepetes unicolor*) guans are large frugivorous birds (> 950 g) that belong to the Cracidae family. The Crested Guan occurs from Mexico to Ecuador and Venezuela,

while Black Guan is endemic of Costa Rica and western Panama (del Hoyo 1994). In Costa Rica, Crested Guans are resident of forested areas from lowlands to 1850 m, while Black Guans are resident in mountains, from the upper limits of the forest down to 1000 m (Stiles & Skutch 1989).

Altitudinal movements had not been reported for these species in Costa Rica (see Stiles 1983, 1985; Blake & Loiselle 2000).

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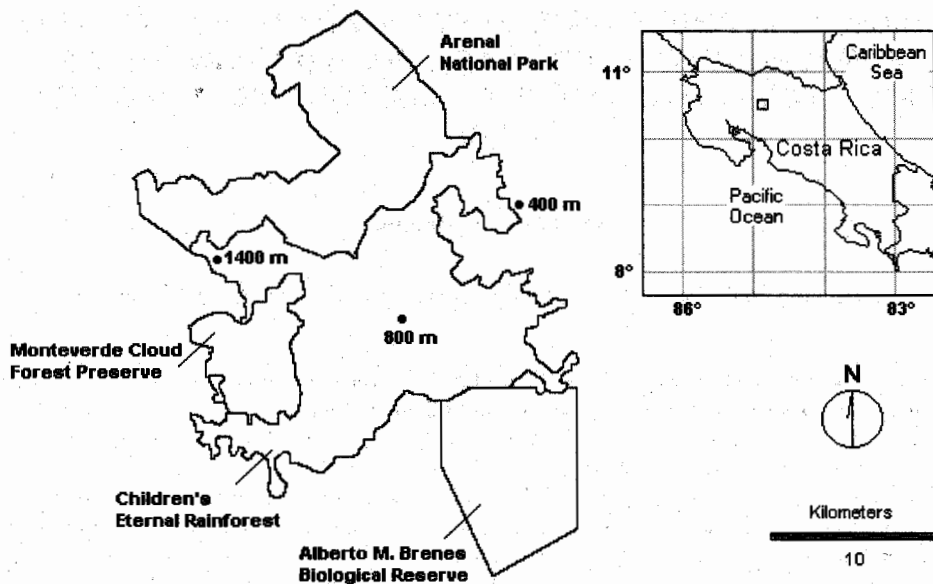


FIG. 1. Study sites along Caribbean slope of Cordillera de Tilarán, Costa Rica. 1998–1999. Elevations represent lower montane rain forest (1400 m), premontane rain forest (800 m), and tropical wet cool transition (400 m).

Nevertheless, some seasonal altitudinal movements have been recorded for Crested Guans in Colombia (del Hoyo 1994), and Stiles & Skutch (1989) suggest that Black Guans can move seasonally to lower elevations in Costa Rica.

Altitudinal migration consists of annual movements between elevations over a range of 500 m or more (Stiles 1983). On the Costa Rica's Caribbean slope, the pattern is similar in all species of frugivorous birds: they breed at high elevations in March–June and then move to lower elevations, where they remain until January or February (Stiles 1988, Loiselle & Blake 1991). As a consequence of research that involved monitoring large frugivorous birds along an elevational gradient on the Caribbean slope of this country (Chaves-Campos 2001), I detected changes in the abundance of both Crested and Black guans that might

indicate altitudinal movements in these two species.

## STUDY AREA AND METHODS

The study area was the Caribbean slope of Cordillera de Tilarán, Costa Rica ( $10^{\circ}18'N$ ,  $84^{\circ}45'W$ ). In this area, continuous protected forest extends from an elevation of 400 m to the top of the mountains (1850 m). The protected areas encompass approximately 40,000 ha, including several protected areas. Life zones in the area are lower montane rain forest, premontane rain forest, and tropical wet forest cool transition (according to the Holdridge system: Haber 2000). The dry season on this slope typically lasts from February to April (Coen 1983, Sanford *et al.* 1994, Clark *et al.* 2000).

Records refer to three study sites that I had established for the research cited above,

at 1400 m, 800 m, and 400 m a.s.l. (Fig. 1). Each elevation corresponds to one of the three life zones: lower montane rain, premon-tane rain, and tropical wet forest cool transi-tion, respectively. All sites were located in old-growth forest.

In each site, I established two 2-km transects on existing trails across mature for-est. I sampled bird abundance in seven sam-pling periods per site, 6–8 weeks apart, between January 1998 and January 1999. Each sampling period consisted of 2 days. On the first day, I walked along one transect from 06:00 to 09:00 h; on the next day, I sampled the other transect using the same methodology. Bird abundance was registered along these transects by recording the number of birds observed or heard during the walks. The median amount of time spent sampling birds per period was 5.9 h, and I conducted at least 3.2 h of walking in every sampling period.

Large fruit-eating birds usually remain around fruiting trees and visit them many times daily (Wheelwright 1991). The transects were at least 2 km apart; therefore, the obser-vations on each trail were probably independ-ent of each other (Solórzano *et al.* 2000).

## RESULTS

I recorded 39 Crested Guans and 8 Black Guans in 122 h of sampling. There was tem-poral variation in Crested and Black guans abundance at each site (Fig. 2). The Crested Guan was present at 1400 m year round, but abundance was higher around June. This abundance peak coincides with its reproduc-tive season (Stiles & Skutch 1989, del Hoyo 1994). After June, abundance decreased at this site, although there was another increase in October. At 800 m, the abundance of this species increased during its non-breeding sea-son, from June to December. I recorded Crested Guans at 400 m only during the non-

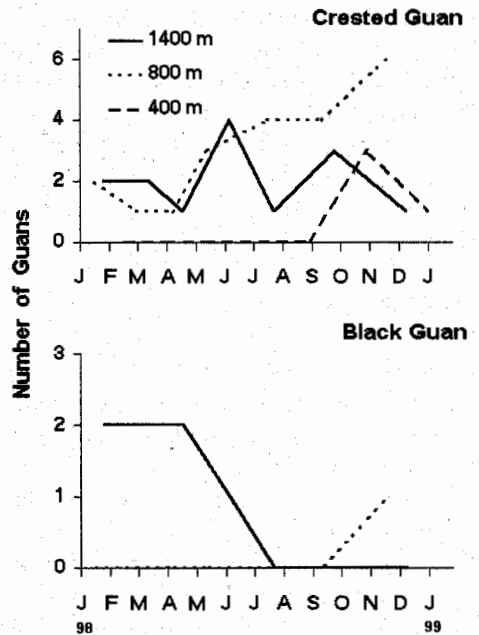


FIG. 2. Temporal abundance of Crested and Black guans along Caribbean slope of Cordillera de Tilarán, Costa Rica, 1998–1999. Elevations represent lower montane rain forest (1400 m), premon-tane rain forest (800 m), and tropical wet forest cool transition (400 m).

breeding season. I registered the species for the first time in November, and I recorded it again in the next sampling period, January 1999. This suggests that Crested Guans remained in that altitude between November and January.

I recorded Black Guans at 1400 m between February and June, during their breeding season (Stiles & Skutch 1989, del Hoyo 1994). I had no records of this species in my transects after June; nevertheless, I confirmed its year-round presence with casual observations outside of the transects. At 800 m, I recorded Black Guans only during the non-breeding season. I observed the species for the first time in September, and thereafter until November. Coincidentally, I also recorded the highest number of Crested

Guans during September–November (Fig 2). Other altitudinal migrants (e.g., Resplendent Quetzals; *Pharomachrus mocinno* and Emerald Toucanets; *Aulacorhynchus prasinus*) that inhabit forests at higher elevations during the breeding season were also observed at 800 m for the first time during this period (Chaves-Campos 2001).

## DISCUSSION

Even taking into account that both species are not common (especially for the Black Guan), the numbers of birds showed a pattern that did not seem to be significantly influenced by problems of detectability related to climatic conditions. In the case of Crested Guans, the peak of abundance in the highest site occurred during the early rainy season (May–June), when it is more difficult to detect birds because of the rain. The period of highest abundance of Black Guans at the highest elevation coincided with the dry season, period when they should be easier to detect because of good weather conditions. Nevertheless, the dry season period is general at all elevations on the Caribbean slope (Coen 1983, Sanford *et al.* 1994, Clark *et al.* 2000), and there were fewer guans of both species at lower elevations during this season. In contrast, the numbers of birds of both species at lower elevations were higher during the rainy season, when it is more difficult to detect birds because of the rain and because they are not breeding and consequently are not displaying.

The pattern of changes in abundance could indicate elevational movements. The temporal pattern for both species is similar to the pattern expected for elevational migrants on the Caribbean slope of Costa Rica: higher abundances at high elevations during the breeding season, and higher abundance at lower elevations in the non-breeding season (Loiselle & Blake 1991, Rosselli 1994). This

pattern has been detected in Cordillera de Tilarán for well-confirmed altitudinal migrants, e.g., Umbrellabirds (*Cephalopterus glabricollis*), even during the relative drought of 1998 caused by El Niño (Chaves-Campos 2001). The temporal pattern of abundance and the temporal concordance at lower elevations with altitudinal migrant species (quetzals, toucanets) suggest that regular altitudinal movements could exist in Crested and Black guans in Costa Rica.

The presence of both species year-round at 1400 m suggests that they could be partial altitudinal migrants. In partial altitudinal migrant species, only some members of the populations are migrants and others are residents (Loiselle & Blake 1991). The changes in abundance of Crested Guans at 1400 m do not seem to indicate a regular movement of a significant proportion of the population from this altitude to lower elevations. It is possible that, at 1400 m, only some individuals migrate, and the migrants at this altitude are replaced by other migrants from higher elevations (Loiselle & Blake 1991, Rosselli 1994). Crested Guans are also expected to be resident in the lowlands of the Caribbean slope of Costa Rica (Stiles & Levey 1994). Protected areas in Cordillera de Tilarán extend mainly above 700 m (Haber 2000, Nadkarni & Wheelwright 2000, Powell *et al.* 2000), and therefore the lowlands are mainly unprotected. My study site at 400 m was very close to but outside the protected areas (Fig. 1), and hunters were present several times in 1998 (Chaves-Campos pers. observ.). It is possible that the resident population of Crested Guans in the lowlands of Cordillera de Tilarán has been diminished by hunting pressure, and the individuals I registered between November 1998 and January 1999 were altitudinal migrants that descended from higher and more protected areas. Nevertheless, temporal variation in abundance could also be a behavioral response to lack of habitat and hunting

pressure not necessarily related with altitudinal migration.

This study is the first documented evidence for the possibility of altitudinal migration in these guans in Costa Rica. A survey of one year is not enough to confirm that both species migrate every year, but suggests that these movements could happen at least in some years. Monitoring of tagged individuals for at least two consecutive years is necessary to definitively confirm the migratory behavior.

The possibility of altitudinal migration in these two species should be considered in strategies for their conservation. Most altitudinal migrants on the Caribbean slope of Costa Rica need continuous forest between highlands and lowlands (Stiles 1985). Both Crested and Black guans are restricted to forested areas (Stiles & Skutch 1989), and at least the Black Guan is reluctant to cross large open areas (Guindon 2000). Both species are currently threatened in Costa Rica (Collar *et al.* 1994) and consequently the forested altitudinal corridors that these guans and other migrants utilize should be protected to ensure their conservation (Loiselle & Blake 1991, Powell & Bjork 1995, Young *et al.* 1998, Blake & Loiselle 2000).

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