

CHANGE IN MOBILITY AMONG CREPUSCULAR GROUND-LIVING BIRDS IN AN ECUADORIAN CLOUD FOREST DURING OVERCAST AND RAINY WEATHER

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Key words: Crepuscular birds, behavior responses to weather, mobility, habitat fragments, survival.

This paper will first describe the normal pattern of activity among six species of crepuscular ground-dwelling birds in a temperate cloud forest in Ecuador and afterwards describe changes in mobility during overcast and rainy weather. Finally the implications of the increased tendency to leave vegetation cover will be discussed with reference to feeding and survival in habitat fragments.

The observed species, Ocellated Tapaculo (*Acropternix orthonyx*), Chestnut-naped Antpitta (*Grallaria nuchalis*), Rufous Antpitta (*Grallaria rufula*), Undulated Antpitta (*Grallaria squamigera*) and Chusquea Tapaculo (*Scytalopus*, unnamed species in the Brown-rumped Tapaculo complex; N. Krabbe, pers. comm.) are all considered crepuscular in their foraging habits. They are all difficult to observe. Ocellated Tapaculo walks on the forest floor or moves through the vegetation above the ground in dark recesses of dense vegetation, especially in bamboo thickets. Chestnut-naped Antpitta hops on the ground or moves around in low vegetation especially in the darkest parts of bamboo thickets. The Rufous Antpitta is less terrestrial, but forages within 2 m of the ground in dense stands of bamboo and adjacent cloud forest undergrowth. The Undulated Antpitta lives on the ground in the interior of dense mossy cloud forest, often with patches of bamboo (Fjeldså & Krabbe 1990, pers. observation). The Chusquea Tapaculo is a terrestrial bird with poor flying capacity restricted to the darkest and densest parts of humid undergrowth (N. Krabbe, pers. comm.). The biology of the very rare Imperial Snipe (*Gallinago imperialis*) is little known. It is considered nocturnal or

crepuscular and lives inside dense elfin forest with bamboo, treeferns and often large amounts of spongy moss (Terborgh & Weske 1972, Hilty & Brown 1988, Fjeldså & Krabbe 1990, Krabbe 1992). It is extremely difficult to observe. The few known observations are mostly silhouettes of flying birds singing at dusk. Here I present observations of this species foraging on open trails during the day.

STUDY AREA

The study area was at Cajanuma (04°06'S, 79°09'W), Podocarpus National Park, Province of Loja, Ecuador. Cajanuma (2750 m) is on the west side of the easternmost ridge of the Andes of southern Ecuador. The weather at Cajanuma is heavily influenced by the extremely humid east side climate. Long periods with mist, clouds and rain apparently prevail from February until mid October. A less wet period with more sunshine and clear sky lasts from mid October through January (Apolo 1984, Bloch *et al.* 1991, park guards, pers. comm.). Exact climatic figures do not exist.

The predominant vegetation is tall primary cloud forest with patches of bamboo on naturally and man disturbed slopes. Epiphytes are heavily developed creating a very high structural complexity and heterogeneity with many microhabitats and a dark interior. The undergrowth is dense, dark and almost impenetrable. Around Cajanuma several open trails were maintained for purposes of ecotourism and research.

Cajanuma is extraordinarily rich in antpittas (6 species) and tapaculos (5 species), which made it ideal for observations of these secretive birds.

METHODS

During a study of mixed species flocks, I recorded crepuscular terrestrial birds on open trails together with weather. In April and May, weather was also recorded every hour from 06:00 to 18:00 h. Weather parameters were cloud cover, sunshine/no sunshine, mist/no mist and precipitation estimated as no rain (dry), dust, light, fine and heavy rain. The sky was divided in parts from 0/8 to 8/8. The former was clear sky and 8/8 was totally overcast. The weather was classified dark at cloud cover 8/8 combined or not with rain and/or mist. A frequency distribution of observations at different cloud cover showed the distinction between 8/8 and less cloud cover to be the best.

I defined observations in the morning as 06:00–10:00 h, at midday as 10:00–14:00 h and in the afternoon as 14:00–18:00 h. Observation efforts in these periods were the same.

All statistical tests were two-tailed. Expected values were calculated from proportions of hours with for example rain compared to the total hours of rain and dry weather during the period of observations. First and last observation of a species defined a period. In the calculations four Imperial Snipes and one Undulated Antpitta were omitted ($n = 44$), because these were records from outside the period when weather data were collected every hour.

RESULTS

More crepuscular birds were seen foraging on open trails (29 of 44) when cloud cover was 8/8 ($n = 127$) than at less cloud cover ($n = 152$) ($\text{Chi}^2 = 7.46$, $P < 0.01$). More crepuscular birds were out in the open (44 of 44) when the sun did not shine ($n = 201$) than during periods of sunshine ($n = 78$) ($\text{Chi}^2 = 17.07$, $P < 0.001$).

On the species level, more Rufous Antpittas (9 of 10) and Chusquea Tapaculos (7 of 7) were out in the open under totally overcast ($n = 84$ and $n = 123$, respectively) than during periods of less cloud cover ($n = 123$ and $n = 148$, respectively) ($\text{Chi}^2 = 10.11$, $P < 0.01$ and $\text{Chi}^2 = 8.41$, $P < 0.01$, respectively). There were no more records of Undulated Antpitta (11 of 24) out in the open during totally overcast ($n = 72$) than at less cloud cover ($n = 110$) ($\text{Chi}^2 = 0.40$, ns). Sufficient data to allow sta-

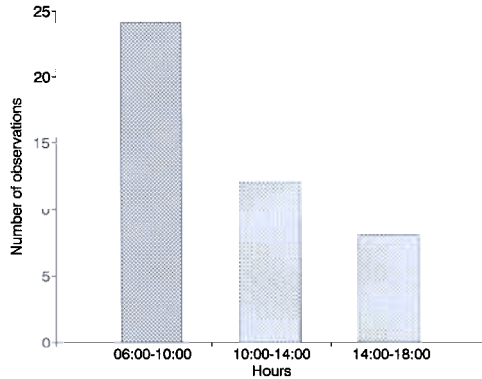


FIG. 1. Daily activity pattern of crepuscular ground-living birds on open trails at Cajanuma.

tistics were not obtained for the last three species.

During rains ($n = 86$) there were more crepuscular birds (22 of 44) out in the open than during dry weather ($n = 193$) ($\text{Chi}^2 = 7.59$, $P < 0.01$). More Chusquea Tapaculos (7 of 7) were out in the open during rains ($n = 72$) than during dry weather ($n = 174$) ($\text{Chi}^2 = 16.90$, $P < 0.001$). There were no more Rufous Antpitta (4 of 10) and Undulated Antpitta (9 of 24) out in the open during rain ($n = 61$ and $n = 58$, respectively) than during dry weather ($n = 149$ and $n = 124$, respectively) ($\text{Chi}^2 = 0.58$, ns and $\text{Chi}^2 = 0.35$, ns, respectively).

In the morning there were more observations of crepuscular birds out in the open ($n = 24$) than at midday ($n = 12$) and in the afternoon ($n = 8$) ($\text{Chi}^2 = 8.0$, $P < 0.01$ and $\text{Chi}^2 = 4.0$, $P < 0.05$, respectively; Fig. 1).

Mist only occurred four times when crepuscular birds were seen. Each time mist was accompanied by totally overcast and rain making the weather extremely dark.

One Imperial Snipe was observed foraging 30 min in the open taking a 10 cm long lumbricid from moss on the ground. Another Imperial Snipe foraged about 20 min along a trail (R. Tapia, O. Mora, pers. comm.). The last two Imperial Snipes both foraged 10 min in the open (J. Fjeldså, E. Bering, pers. comm.). All observations were from the same area of *Chusquea* bamboo during days with totally overcast and rainy weather. Three observations also inclu-

ded mist. On several occasions with rain and shortly afterwards Undulated Antpittas were observed taking 10 cm long lumbricids from moss, soil and surface.

DISCUSSION

More crepuscular ground-living birds are foraging in the open outside their dark interior cloud forest habitat during totally overcast and rainy weather than at less overcast and dry weather.

Foraging in the open could be ascribed to the generally more intensive feeding activity in the morning (Fig. 1). This is not surprising considering the overnight fast, birds starting on an empty stomach and a habitat chiefly in shade behind the eastern ridge.

Totally overcast weather combined or not with rain and/or mist may be the factor that extends the darkness, preferred by the crepuscular birds, to open trails. Hence, dark weather may be perceived as the necessary "cover" for shy, ground-living birds of the forest interior to come out foraging in open habitats or to cross open space safely.

Ground foraging birds are generally considered the first species to be entrapped when fragmentation creates habitat isolates. Physiological and behavioral constraints may limit or preclude their movements. While higher strata species may expand their foraging volume vertically and horizontally, ground foraging species can only adjust horizontally to compensate habitat reduction (Bierregaard & Lovejoy 1989). Given a certain need of forest volume and a reduced habitat, this compensation may prove to be impossible. In such a case dark and rainy weather may provide the necessary "cover" to cross from one fragment to another close by, perhaps breaking down isolation and preventing immediate local extinction. Long-term survival will eventually depend on the size of the frag-

ments (Bierregaard & Lovejoy 1989) or sufficient mobility motivation to make use of several small fragments as a home-range. This should be investigated in further details.

ACKNOWLEDGEMENTS

The Danish National Science Research Council, Copenhagen (grant 11-9116) and The Zoological Museum, University of Copenhagen provided financial support to this study. The Ministerio de Agricultura y Ganadería in Quito provided permission to do research in Ecuador. The study was done in cooperation with Universidad Nacional de Loja and Dr. D. Espinosa. I thank A. Frølander and P.A. Cueva for help during the fieldwork and N. and J. Krabbe for hospitality in Quito. R. Tapia, O. Mora, J. Fjeldså and E. Bering kindly let me use their data on Imperial Snipe. I also thank J. Fjeldså for supervision and J. Rabøl and C. Rahbek for valuable comments on the manuscript.

REFERENCES

- Apolo B., W. 1984. Plan de manejo Parque Nacional Podocarpus. Ministerio de Agricultura y Ganadería, Quito.
- Bierregaard, R. O., Jr., & T.E. Lovejoy. 1989. Effects of forest fragmentation on Amazonian understory bird communities. *Acta Amazonica* 19: 215–241.
- Bloch, H., Poulsen, M. K., Rahbek, C., & J. F. Rasmussen. 1991. A Survey of the Montane Forest Avifauna of the Loja province, Southern Ecuador. ICBP study report 49.
- Fjeldså, J., & N. Krabbe. 1990. Birds of the High Andes. Svendborg.
- Hilty, S.H., & W.L. Brown. 1988. Birds of Colombia. Princeton.
- Krabbe, N. 1992. Notes on distribution and natural history of some poorly known Ecuadorean birds. *Bull. Brit. Ornithol. Cl.* 112: 169–174.
- Terborgh, J., & J.S. Weske. 1972. Rediscovery of the Imperial Snipe in Peru. *Auk* 89: 497–505.

Accepted 22 July 1993.