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SHORT COMMUNICATION

Predation of birds in mist nets by callitrichids (primates): how to prevent similar events

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ABSTRACT

We report predation of four birds while caught in mist nets and recommend some means of prevention. Two birds were attacked by *Callitrhix jacchus* and one by *Saguinus midas*. The predator in the fourth case was unidentified. These cases were relatively rare, affecting 0.4–4.4% of the captured birds. Two of the predated birds were caught more than 1 m above the ground and may have been accessed from branches. The other two were caught close to the ground. Reducing time intervals between net checks and cutting off branches close to nets may reduce bird predation in mist nets.

RESUMO

Reportamos a predação de quatro aves em redes de neblina e indicamos medidas para prevenir tais eventos. Duas aves foram predadas por *Callithrix jacchus* e uma por *Saguinus midas*. O predador da quarta ave não foi identificado. Estes casos foram raros, afetando 0.4–4.4% das aves capturadas. Duas aves foram capturadas a mais de 1 m acima do solo e foram acessadas a partir de galhos. As outras duas foram capturadas perto do chão. Reduzir os intervalos entre as verificações das redes e cortar os galhos próximos às redes pode reduzir a predação de aves em redes de neblina.

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Introduction

Mist nets are among the main methods for surveying birds and bats. The method has several advantages, such as: (1) detecting inconspicuous species that are hardly detected by other methods; (2) obtaining counts of individuals and species that are relatively unbiased by observer skill; (3) easy standardizing of sampling effort; and (4) allowing captured individuals to be individually marked, and checked for sex, age, reproductive status and precise species identification (Dunn & Ralph 2004).

Despite the importance of mist nets, they can result in death of some individuals, raising ethical, conservational and sampling issues. Mortality can occur due to injury, thermal stress, shock or predation (Recher et al. 1985), and researchers should strive to maintain bird mortality below 1% (Ralph et al. 1993).

Predation of birds in mist nets has been reported by birds of prey, other bird species, spiders, ants, carnivorous mammals, white-tailed deer (*Odocoileus virginianus*), eastern cottontails (*Sylvilagus floridanus*), squirrels (*Sciurus* sp.) and eastern chipmunks (*Tamius striatus*) (Recher et al. 1985; Brooks 2000; Ruiz-Esparza et al. 2012; Spotswood et al. 2012; Carvalho et al. 2016). In addition, Brooks (2000) reported 17 observations of blue monkeys (*Cercopithecus mitis*) preying on birds in mist nets. Nonetheless, predation of birds in mist nets by primates seems to be rare.

Here, we report events of predation of birds trapped in mist nets by two species of Callitrichidae, the common marmoset (*Callitrhix jacchus*) and the golden-handed tamarin (*Saguinus midas*), and discuss some ways to prevent similar events. Callitrichidae are small primates (<600 g – Rosenberger 1992) that feed on plant exudates, fruits, flowers, nectar, fungi, leaves, and small animals (Peres 1993; Porter 2001; Hilário & Ferrari 2010; Digby et al. 2011; Amora et al. 2013). Invertebrates are the most frequent prey, although these primates can also capture small anurans, lizards, bird nestlings and small mammals (Peres 1993; Digby & Barreto 1998; Porter 2001; Hilário & Ferrari 2010).

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Flying vertebrates appear to be eaten only opportunistically (Silva et al. 2008; Hilário & Ferrari 2010).

Materials and methods

Study sites

Observations took place in two study sites. Ibura National Forest – INF (10°50′19”S, 37°08′30”W) is a 144 ha Atlantic Forest reserve located at the state of Sergipe, Northeastern Brazil (Figure 1). The INF encompasses different habitat types, which include semideciduous forest (81%), mangrove (6%), pasture (4%), and an abandoned plantations of *Eucalyptus globulus* and *Pinus elliottii* (9%) in which undergrowth has been regenerating for 35 years (Santos 2001; Gomes et al. 2006; Silva & Souza 2014).

The second study area incorporated margins of a road in process of pavement (AP 426) (02°03′50”–01° 43′29”N, 50°49′31”–50°51′58”W), in the state of Amapá, in the northernmost part of the Brazilian Amazon (Figure 1). The road is located in an area of savanna with large plantations of *Eucaliptus* sp. and patches of riparian forest. The primate species involved in the predations (common marmosets and golden-handed tamarins) are frequently observed (i.e. daily) at both study sites.

Fieldwork

For a bird inventory at INF we operated 10 mist nets (12.0 m × 2.5 m; 20 mm mesh) for five to six days each month, from July 2012 to August 2013, at locations that allowed the sampling of all habitats within INF. We opened nets in the morning (05:00–10:00 h) and in the afternoon (15:00–18:00 h), totaling 6.720 net-hours. We checked nets at 20 min intervals.

At the second site we surveyed four sampling points for five days each, totaling 20 sampling days. The sampling occurred in March 2014. All sampling was

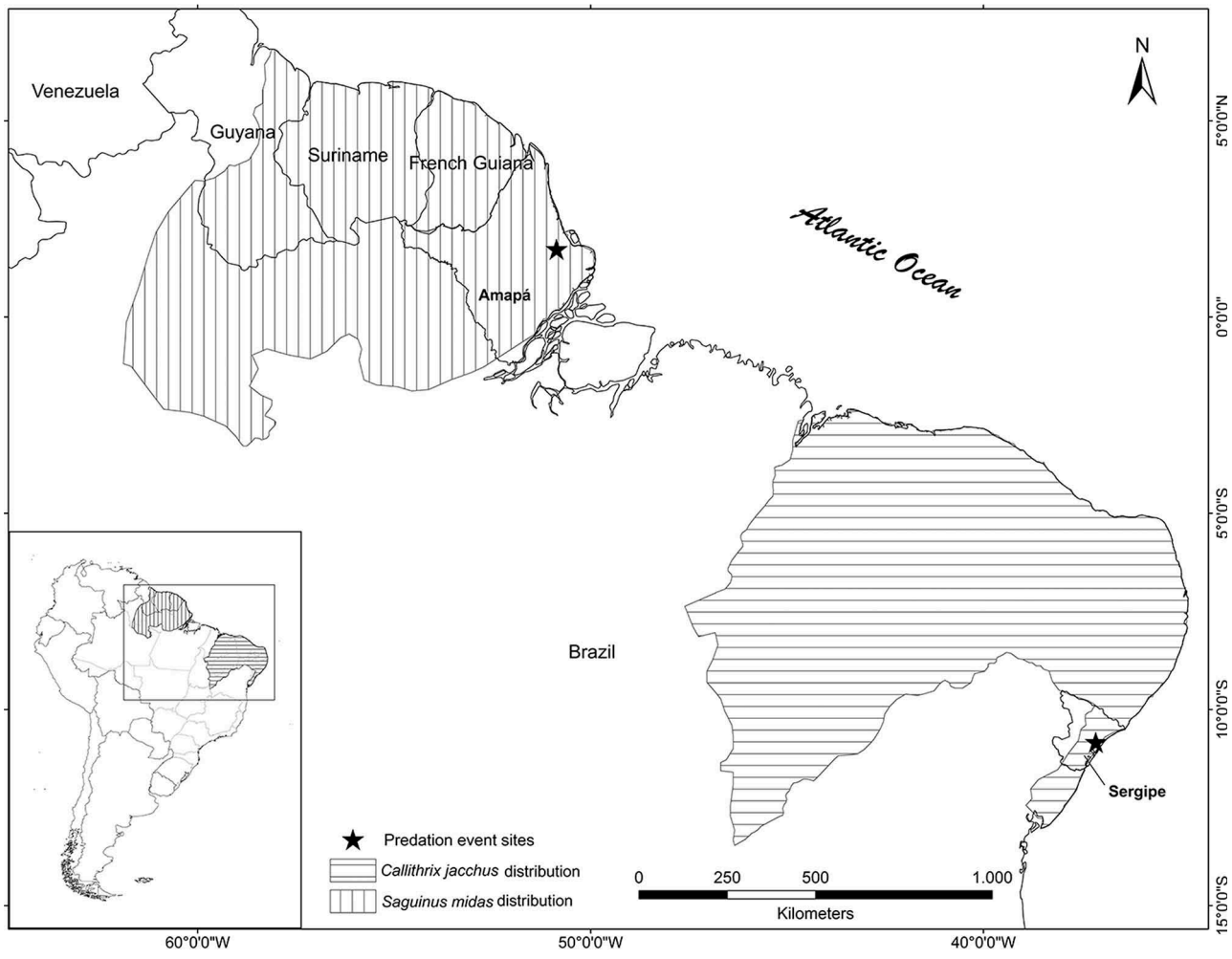

Figure 1. Locations where the predation events were observed. The geographic distributions of the predator species (*Callithrix jacchus* and *Saguinus midas*) are also shown.

within patches of riparian forest. At each sampling point, we operated 10 mist nets (10.0 m × 2.5 m; 20 mm mesh) from 06:00 to 10:00 h and from 16:00 to 19:00 h, totaling 1.400 net-hours. Here we checked the mist nets at 30 min intervals. Differences in the time mist nets were open reflect differences in dawn and dusk time in the two study areas.

Results

Common marmosets preyed on birds captured in mist nets on 20 February 2013, between 09:00 and 10:00 h, at an abandoned *Eucalyptus* plantation. One of us (CS) approached the mist nets and observed a common marmoset caught in a net about 10 cm above the ground. Another marmoset was sitting on a branch 1.5 m above the ground. The tangled marmoset started struggling and freed itself when it saw the observer, then climbed to a branch close to the other marmoset. The observer found blood, feathers and a bone fragment in the mist net at the spot where the marmoset was caught, as well as a wing fragment on the ground close by. There was a second set of blood and feathers in the mist net mesh close to the place where the second marmoset was sitting. Although the evidence indicates two birds were killed, we could identify only one of them, based on a wing fragment: an Ochre-Lored Flatbill (*Tolmomyias flaviventris*; 12 cm, 11 g; Figure 2).

In total we captured 516 birds during the study in the INF, so the predation mortality rate was 0.38%. Throughout this study, we frequently observed common marmosets vocalizing repeatedly and staring at birds caught in nets. The predation event took place when the observers left the mist nets unchecked for a period of approximately 30 min instead of the usual 20 min for this study site. The longer interval occurred due to a high number of captured birds, which were being measured during this interval. This situation was, nevertheless, relatively infrequent (i.e. no more than once every three days).

Predation by golden-handed tamarin took place on 15 March 2014, at 09:30 h. We heard tamarins vocalizing loudly and repeatedly before we approached the mist nets. Upon our approach, the tamarins quickly fled the area. We then observed the wings and legs of a Pale-Breasted Thrush (*Turdus leucomelas*; 22 cm, 72 g) caught in the net approximately 1.30 m above the ground. The body of the bird was not found. Four individuals of Crimson-Hooded Manakins (*Pipra aureola*; 11 cm, 16 g) were caught in the same mist-nets at the same time as the predation occurred, but none of them showed any signs of attack. Although we did not observe golden-handed tamarins actually killing the bird, we are confident these primates were responsible, for several reasons. First, we had observed the tamarins close to the net and even touching it before the attack. Second, we did not find any evidence of the presence of other potential predator. Lastly, the point at which the bird was killed was close to a branch that could have served as platform that allowed the tamarins to reach the mist nets. The following day, another predation took place at a different sampling point. However, in this case, the predated bird (*Pipra aureola*) was caught about 0.4 m above the ground and we did not find any clue to identify the predator. Tamarins, but also other terrestrial animals, could have been responsible. The bird that we are confident was predated by a golden-handed tamarin represented 2.2% of the 46 birds captured at this study site. If we consider both predated birds, the percentage rises to 4.4%.

Discussion

The primate predations reported were rare events. Predation by common marmosets at the INF site was

Figure 2. The wing fragment of the Ochre-Lored Flatbill, *Tolmomyias flaviventris* (A) and an adult individual of the same species (B). The diagnostic character used to identify the species is pointed by an arrow.

below the target maximum level of 1% suggested by Ralph et al. (1993). However, mortality exceeded target maximum at the Amapá site. Only 46 birds were captured there, due to heavy rains during the study, so the high rate of mortality might have been a chance, unrepresentative event.

The predations reported here reflect the behavioral flexibility of primates. Although callitrichids commonly prey on bird eggs and nestlings (Digby & Barreto 1998; Lyra-Neves et al. 2007; Hilário & Ferrari 2010), adult birds do not appear to be common prey items. High mobility likely prevents their capture by primates, although flying vertebrates do appear in the diet on occasion. Silva et al. (2008) reported predation of a Ruddy Ground Dove (*Columbina talpacoti*) by black-tufted marmosets (*Callithrix penicillata*) while Hilário and Ferrari (2010) reported predation of an unidentified bat by buffy-headed marmosets (*Callithrix flaviceps*). Birds immobilized in mist nets would be easy prey for these primates, which are generally attracted to mist nets by the noise produced by the captured birds (Roos 2010). In spite of being rare events, the geographic range of the observations we reported here, as well as the involvement of two different primate species, indicate that bird predation in mist nets by callitrichids may not be isolated cases, and similar events could happen again in other localities. Therefore, it is important to develop strategies to prevent predation of captured birds by marmosets and tamarins.

The higher predation rate occurred at the site with 30 min intervals between net checks, and at the INF site, where nets were normally checked every 20 min, the sole predation event occurred when nets were left for 30 min. The frequent presence of researchers close to nets appeared to inhibit attacks, and other studies already pointed that short intervals between checks can reduce bird predation and mortality caused by other factors (Recher et al. 1985; Brooks 2000). We therefore recommend shorter intervals (e.g. 15–20 min) between mist net checks in field sites with the presence of primate species that can potentially prey on birds. A balance must be struck, however, as shorter intervals might also deter capture of target species. Although predation events may take less than 15 min to occur, short checking intervals increase the chance of observing the primates nearby the mist nets prior to the attack. Then, the researchers can maintain themselves vigilant to avoid predation.

A second recommendation is to reduce ready access to the mist nets. Although in at least one of the predation events the bird was accessed by the ground, in both study sites the primates may have accessed their prey using branches close to the nets. Therefore, cutting branches near mist nets is a simple, low impact strategy that may reduce this kind of predation.

Although predation of birds in mist nets by primates is rare, simple measures such as those proposed here may reduce the odds of incidence. We suggest that the researchers adopt these recommendations to reduce predation of birds in mist nets by primates.

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Disclosure statement

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