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Avian Mobbing of the Puerto Rican Boa (*Epicrates inornatus*)

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Mobbing, defined as an intense collective behavior in which birds of one or more species scold or even physically attack a predator, is known from a variety of bird species (Campbell and Lack, 1985; Gill, 1995). Targets commonly include hawks, owls, and snakes. In the West Indies, observations have documented avian mobbing towards various hawk species (e.g., Jeffrey-Smith, 1972; Van Barneveld, 1993); mongoose, *Herpestes auropunctatus* (Downer, 1977); and even anole lizards, *Anolis garmani* (Salmon, 1976), but not towards snakes. The absence of such observations may be due to the difficulty of detecting the actual target of the mobbing birds, particularly when obscured by dense canopy vegetation. We have frequently observed mobbing birds without locating their target, although we have often suspected it could be a snake. Here we document four incidences of avian mobbing directed at Puerto Rican boas (*Epicrates inornatus*), which we observed during a four-year radio telemetry study of the boa in the Luquillo Experimental Forest (LEF) in eastern Puerto Rico.

The LEF is an evergreen forest consisting of four major forest types, approximately stratified by altitude (Wadsworth, 1951). Our boa studies were mostly confined to the lowland tabonuco forest (300 – 600 m), named for the dominant tabonuco tree (*Dacryodes excelsa*) in the subtropical wet forest zone (Ewel and Whitmore, 1973). We used radio receivers to locate snakes with surgically implanted transmitters and used 10 × 40 binoculars to observe snakes and birds. Total length (TL) of all captured snakes was measured from the tip of the snout to the tip of the tail. Our observations of mobbing are as follows:

1. 12 November 1997, 13:45 hrs on a ridge above La Maquina Creek, near Route 191, Km 6.5. - The female boa (Cucusa, 212 cm TL) moved into a small shrub and assumed an s-shaped defensive posture. A Bananaquit (*Coereba flaveola*) repeatedly approached while making rapid and continuous scolding vocalizations. The snake continued in its defensive posture and no other birds responded to the Bananaquit during approximately 6-10 min of observations.
2. 21 December 1998, 13:00 hrs, along Route 191 at Km 5.5. - While watching a female boa (Velda, 205 cm TL), we observed a pair of Puerto Rican Striped-headed Tanagers (*Spindalis portoricensis*) vocalizing intensively at the snake from approximately 1 m.

- The tanagers were almost immediately joined by a flock of five Puerto Rican Tanagers (*Nesospingus speculariferus*) and then by three Bananaquits, one Northern Parula (*Parula americana*), and a female Black-throated Blue Warbler (*Dendroica caerulescens*). The Puerto Rican Tanagers flew to within 30 cm of the snake, whereas the other species, although diving at the snake, approached only to within 50 cm. All the birds surrounded the snake and approached it 10-20 occasions each, as the snake descended the tree and hid under leaf litter.
3. 24 February 1999, 13:00 hrs near Route 191 at the intersection with Route. 9966. - We located a female boa (154 cm TL) partially hidden in the top of a 3 m tall hollow stump of a *Cecropia schreberiana* tree, after hearing the intense scolding calls of Puerto Rican Tanagers and Puerto Rican Woodpeckers (*Melanerpes portoricensis*). From dead vines hanging near the tree trunk, five tanagers individually flew towards the snake each on about ten occasions, sometimes getting as close as 25 cm from the snake. The two woodpeckers scolded intensely from a tree about 3 m from the snake. The birds flew away as we approached the snake.
 4. 17 April 2000, 11:00 hrs, Route 191, Km 5.9- Loud, continuous scolding vocalizations led us to a female boa (184 cm TL) basking about 6 m high in a leaning *Guarea guidonia* tree. The birds congregating around the snake included four Puerto Rican Tanagers (one a juvenile), two Puerto Rican Bullfinches (*Loxigilla portoricensis*, one a juvenile), and two Bananaquits. The birds flew towards the snake on 15 or more occasions, sometimes approaching to within 30 cm of the boa. The snake reacted by slowly moving up the leaning trunk. The birds departed only after we started to capture the boa.

Apart from the above observations, we have made over 20 sightings of various birds (usually including Puerto Rican Tanagers) giving intense scolding vocalizations at areas hidden in the vine-covered tree canopy. Vocalizing birds approached these sites in the same manner as we observed when birds mobbed snakes.

Boas may be easier for birds to detect when basking, which occurs most frequently on sunny days after successive cool rainy days, and especially during periods when females are gravid. Large boas (> 1.5 m) are probably more easily detected, and it may be no coincidence that the four boas we observed being mobbed were females, which tend to be larger than males in the LEF (unpubl. data).

Bananaquits and Puerto Rican Tanagers were consistently encountered mobbing boas. In the case of Bananaquits, the initial discovery of a snake occurs probably because of their overwhelming abundance in the LEF (Wunderle et al., 1987) and their generalized foraging behavior across broad strata of vegetation. Although not as abundant as Bananaquits, Puerto Rican Tanagers frequently forage in small family groups, often moving through thick foliage where they are likely to encounter boas. Tanagers are social and often very

vocal and loud; therefore, observers are more likely to detect them than other species.

We observed seven bird species mobbing boas (two winter residents and five permanent residents). However, we expect that most passerines, at least, would be likely to mob boas. Previous studies indicate two potential advantages of mobbing: driving away predators and helping birds improve their predator detection and recognition skills. Avian mobbing of Puerto Rican Boas is relatively ineffective at driving large (>1.5 m) boas away, but may help inexperienced birds associate danger with the mobbing vocalizations. This is especially important for juvenile birds that may learn to recognize predators as a result of parental mobbing behavior. The frequently observed mobbing behavior of Puerto Rican Tanagers in family groups is consistent with the latter explanation.

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