



RECORDS OF MOBBING BEHAVIOR IN VENEZUELAN WILD BIRDS

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Abstract · Mobbing is a survival strategy in which a small bird attacks larger and more powerful perceived enemies (e.g., potential predators) to drive them away from the vicinity. This paper reports and describes mobbing events performed by Venezuelan wild birds, which were recorded opportunistically in different localities of the country. A total of 31 species from 15 families were recorded in 131 mobbing events. Individual mobbing was the tactic most frequently recorded in 83 mobbing events (63%) whereas 36 events (28%) involved the additional assistance of conspecifics, and only 12 (9%) involved non-conspecific allies. Birds tended to mob individually when the enemy was flying but they tended to do so as a group when the enemy was perched. Most of the recorded mobbing events (109 events, 83%) served an anti-predatory function, but mobbing was also performed for food resource protection (17 events, 13%), and site defense (five events, 4%). Mobbing behavior was recorded during the breeding season in 16 species with 75 mobbing events (58%) occurring in that period. Eight mobber species were also mobbed. Most mobbing events (98%) were initiated by the weaker species (bird having smaller body size or mass). Important differences were found in body size and body mass between the mobber and mobbed species. In general, a mobber engaged in mobbing against other birds of similar or larger body size (up to 5.6 times larger) or larger body mass (up to 117.5 times heavier). In most mobbing events (54%) a mobber attacked birds that doubled it in size, and in 75% of the events, the mobbed bird was three times heavier than the mobber. Only the Roadside Hawk *Rupornis magnirostris* and the Tropical Kingbird *Tyrannus melancholicus* were exposed to true danger when they were counter-attacked, and almost caught, by Common Black Hawks *Buteogallus anthracinus*. The records collected here contribute to the data on mobbing behavior in wild birds worldwide and noticeably improve the repository of available knowledge in Venezuela and the Neotropical region.

Resumen · Registros de comportamiento de acoso en aves silvestres venezolanas

El acoso es una estrategia de supervivencia en la cual un ave pequeña ataca a enemigos más grandes y poderosos (e.g. depredadores potenciales) para expulsarlos de las inmediaciones. Este artículo reporta y describe eventos de acoso en aves silvestres de Venezuela, registrados de manera oportunista en diferentes localidades del país. Un total de 31 especies pertenecientes a 15 familias fueron registradas en 131 eventos de acoso. El acoso individual fue la táctica más común, registrada en 83 eventos de acoso (63%), mientras que en 36 eventos (28%) fue necesaria la asistencia adicional de conespecíficos y solo en 12 (9%) se involucraron aliados no conespecíficos. Las aves acosadoras prefirieron acosar solas cuando el enemigo estaba volando, mientras que se inclinaron por acosar en grupo cuando el enemigo estaba posado. La mayoría de los eventos de acoso registrados (109 eventos, 83%) cumplieron una función antidepredadora, pero el acoso también fue realizado para proteger un recurso alimentario (17 eventos, 13%) y defender un lugar estratégico (cinco eventos, 4%). El comportamiento de acoso fue registrado durante el período reproductivo en 16 especies y 75 eventos de acoso (58%) ocurrieron durante el mismo. Ocho especies acosadoras también fueron acosadas. La mayoría de los eventos de acoso (98%) fueron iniciados por la especie más débil (el ave de menor talla o masa corporal). Se encontraron diferencias importantes entre el tamaño y la masa corporal del ave acosadora y el ave acosada. En general, un ave acosadora participó en un evento de acoso con otras aves del mismo tamaño o superior (hasta 5,6 veces más grande) o de mayor peso (hasta 117,5 veces más pesada). En la mayoría de los eventos (54%) un acosador tuvo que acosar aves que duplicaban su tamaño y en 75% de los eventos triplicaban su peso. Solo el Gavilán Habado *Rupornis magnirostris* y el Pitirre Chicharrero *Tyrannus melancholicus* estuvieron expuestos a un verdadero peligro cuando fueron contra atacados por el Gavilán Cangrejero *Buteogallus anthracinus*, que por poco los captura. La información recolectada incrementa los datos relacionados al comportamiento de acoso en aves silvestres a nivel mundial y mejora de manera importante el conocimiento disponible en Venezuela y la región Neotropical.

Key words: Animal defense · Anti-predatory behavior · Bird behavior · David and Goliath battle.

INTRODUCTION

The first record of mobbing behavior in birds probably comes from the Greek philosopher Aristotle, who mentioned a small wren-like bird fighting with an eagle (Cresswell 1878). Yet, the concept of mobbing was properly coined by Hartley (1950) who defined it as “a demonstration made by a bird against a potential or supposed enemy belonging to another and more powerful species...” (Altmann 1956). The literature has focused almost exclusively on predators as the “enemy”, and mobbing has mainly been considered an anti-predatory behavior (Caro 2005, Cunha 2017). Mobbing certainly constitutes an anti-predatory strategy (Dutour et al. 2016, Cunha 2017, Lima et al. 2018), together with escaping, vigilance, counter-attacking (Cunha 2017), thanatosis (Gilman et al. 1950, Cunha 2017), distraction (Burton 1985, Sordahl 1990) and alarm calls (Caro 2005, Magrath et al. 2007, Sternalski & Bretagnolle 2010, Gill & Bierema 2013). However, a bird can also displace a potentially risky non-predator species (e.g. brood parasite) from the nesting area, thus improving the chances of survival of its offspring (Welbergen & Davies 2009). Therefore, the general function of mobbing is to repel and keep the enemy away (Curio et al. 1978, Flassekamp 1994, Cunha 2017), reducing the risk for the individual (Pavey & Smyth 1998) and its relatives. Additionally, mobbing has been suggested to have important evolutionary and social functions, because a bird may display, to the opposite sex, its good health and ability to repel unwanted intruders (Arnold 2000). Mobbing can also include display behaviors stimulated during aggressive intraspecific interactions (Dow 1975), serve as an opportunity to recruit partners for future mobbing events (Krams et al. 2008), and teach offspring predator-specific defense strategies (Curio et al. 1978, Dutour et al. 2017). Birds sometimes mob their enemies even if they are not a threat at the time (Altmann 1956), so in this context, mobbing constitutes a preventive behavior. While mobbing can sometimes be deadly (Sordahl 1990, Caro 2005, Motta-Junior 2007), the risk of not mobbing could be greater (Shields 1984).

Mobbing behavior varies in many ways within and across species. Even though a single individual usually initiates mobbing behavior, it occasionally requires additional support from conspecifics or heterospecifics, and therefore a group of birds is often observed mobbing a common enemy (Shields 1984, Hurd 1996, Arnold 2000, Hernández 2013). Mobbing activity also varies seasonally and is often most intense during the breeding season (Altmann 1956, Curio et al. 1978, Shedd 1983, Shields 1984, Krams & Krama 2002). Mobbing against predators is the most ubiquitous and best documented behavior (Dutour et al. 2017), with hawks and owls being the most consistent targets (Dutour et al. 2016). Other forms of mobbing which are unusual and less evident have been underestimated. For example, predator-predator mobbing is almost unknown and only a few records have been reported in the Neotropics; those involve the Chimango Caracara *Milvago chimango* (Sick 1993), the Merlin *Falco columbarius*, the Aplomado Falcon *F. femoralis* (Terife & Lentino 2018, 2019) and the Yellow-headed Caracara *Milvago chimachima* (Cortés-

Suárez 2021). In addition, mobbing may be used to monopolize a resource (Dow 1977) or to protect the nest from brood parasites (Robertson & Norman 1976, Welbergen & Davies 2009, Gloag et al. 2013, Vereá et al. 2016).

Information about mobbing behavior in Neotropical birds has been considered scarce (Castro-Siqueira 2010), but several observed instances of mobbing are concealed within traditional ornithological literature (Cherrie 1916, Sick 1993, Meyer de Schauensee & Phelps 1978, Hilty 2003, Fitzpatrick 2004, among others). Most data come from Brazil (Sick 1993, Motta-Junior 2007, Castro-Siqueira 2010, Cunha et al. 2017, Lima et al. 2018) with scattered records from Paraguay (Smith 2006), Costa Rica (Sandoval & Wilson 2012), Argentina (Gloag et al. 2013), French Guiana (Tilgar & Moks 2015), and Colombia (De la Ossa et al. 2018, Cortés-Suárez 2021). In Venezuela, the first evidence of a mobbing behavior was reported by Robinson & Richmond (1895) between a Buffy Hummingbird *Leucippus fallax* and a Tropical Screech-Owl *Megascops choliba*. The Ruby-topaz Hummingbird *Chrysolampis mosquitos*, the Long-tailed Sylph *Agelaiocercus kingi*, the Southern Lapwing *Vanellus chilensis* and the Tropical Mockingbird *Mimus gilvus* behave aggressively toward raptors and raptor-shaped birds (birds that resemble a raptor in size and shape) as well (Deery de Phelps 1955, Hilty 2003, Restall et al. 2006, Sainz-Borgo 2016, Vereá et al. 2016). Additional examples of mobbing birds in Venezuela include several Tyrannidae, such as the Tropical Kingbird *Tyrannus melancholicus*, the Gray Kingbird *T. dominicensis*, the Boat-billed Flycatcher *Megarynchus pitangua* and the Great Kiskadee *Pitangus sulphuratus*, which attack and vigorously chase toucans, vultures, caracaras, and hawks (Cherrie 1916, Meyer de Schauensee & Phelps 1978, Sick 1993, Hilty 2003, Restall et al. 2006). In addition, Black-capped Donacobius *Donacobius atricapilla* have been observed mobbing Purple gallinules *Porphyrio martinica*, particularly at hatching time (Vereá et al. 2016).

This study aims to report bird-to bird mobbing events in Venezuela, providing descriptive information on each mobbing event, including the species involved, mobbing tactic used (individual, conspecific, interspecific), and intended function (anti-predatory, site defense, food resource protection). This work also explores the mobber's attack tactic (individual, group) in relation to the activity of the mobbed bird (flying, perched), how consistently that mobbing behavior is initiated by the bird with the smaller body size or mass (weaker species), as well as the range of relative body size and mass in which the mobber bird will engage in mobbing to expel the potential enemy.

METHODS

Study area. Mobbing events were recorded opportunistically in various locations in northern Venezuela between 2005 and 2021. Most observations were made on Los Naranjos farm (10°26'14"N–66°47'27"W), a disturbed area on the Coastal Mountain Range located in the southeastern suburbs of Caracas, El Hatillo County, Miranda state. Additional records were obtained from Topotepuy Ecological Gardens (10°25'00"N–66°51'04"W), Miranda state; Central University of Venezuela,

Maracay campus (10°16'17"N–67°36'47"W), Aragua state; Turiamo (10°25'59"N–67°50'53"W) and Rancho Grande (10°20'59"N–67°41'04"W) areas, Henri Pittier National Park, Aragua state; Laguna Taiguaiguay (10°08'57"N–67°28'46"W), Aragua state; El Faro Island (10°17'29"N–64°36'19"W), Mochima National Park, Anzoátegui state; Pueblo Nuevo (11°57'45"N–69°55'24"W), Península de Paraguaná, Falcón state; and La Viña, Valencia (10°12'57.09"N–68°01'12.70"W), Carabobo state.

Mobbing records. I only recorded bird-to-bird mobbing events individually with Swarovski (10x40) binoculars. Following the published mobbing literature (Caro 2005, Graw & Manser 2007, Sternalski & Bretagnolle 2010, Dutour et al. 2017, among others), I define the mobber (aggressor) as the bird that displays, confronts, attacks, or chases to drive a potential enemy away, and the mobbed as the bird that is attacked by the mobber. On each observation, I recorded the number of individuals and species involved, the number of attack rounds needed to drive the enemy away, the reaction of the individual(s) mobbed, and a brief description of the mobbing event itself. When possible, the mobber's breeding condition was recorded. Breeding condition was evidenced by the presence of active nests near the area where the mobbing event occurred or by the observation of birds carrying nest material. Counterattacks by the mobbed were also recorded. Because mobbing is difficult to determine (Caro 2005), especially when a non-predator is involved, those records were based on the insistence of the mobber on evicting the potential enemy by at least two attack rounds. Sometimes non-predator birds resemble a raptor in size and shape, particularly when they glide, and those were referred to as raptor-shaped birds. Since mobbing could be performed by a single individual, or multiple individuals of the same or different species (Shields 1984), three mobbing tactics were proposed: a) individual mobbing, a single individual mobs alone; b) conspecific mobbing, two or more individuals of the same species mob together; and c) interspecific mobbing, two or more individuals of different species mob together. Although mobbing seems to serve a mainly anti-predatory function (Caro 2005), it may serve other functions as well (Dow 1977). Based on the literature, three mobbing functions were proposed: a) anti-predatory, a bird(s) mobs to reduce the immediate risk of individual predation or predation of its relatives (Cunha 2017); b) site defense, a bird(s) mobs to defend its territory or a particular portion of it (e.g., hunting spot, nesting area) (Shields 1984); and c) food resource protection, a bird(s) mobs to defend and/or monopolize a food resource (Dow 1977). Because mobbing behavior is initiated by the member of the weaker species (Hartley 1950, Altmann 1956), body size (total length) and body mass ratios between the mobber and mobbed species were estimated to explore the range in which mobber birds engage in mobbing to expel a potential enemy. In a mobbing event, the bird with smaller body size or mass was considered the weaker species. Body sizes were based on Meyer de Schauensee & Phelps (1978) and body masses were based on Vereá et al. (1999) and Dunning (2008).

Statistical analyses. A Shapiro-Wilk Test was applied to exam-

ine the normality of the data set. Then, a non-parametric Wilcoxon Signed-rank Test was employed to compare differences in body size and mass between mobber and mobbed as a way to assess whether mobbing behavior was initiated by the weaker species. Further, I used a contingency table to detect the association between the mobber's attack tactic (individual or group) and the activity of the mobbed bird (flying or perched) at the time of the mobbing event. Statistical analyses were performed with PAST V. 3.13 (Hammer et al. 2001).

RESULTS

A total of 31 species from 15 families were recorded in 131 mobbing events. Fourteen species (45%) had no previous records of mobbing behavior. Table 1 shows a summary of the information collected. Individual mobbing was the most frequently recorded tactic, occurring in 83 mobbing events (63%), compared to 36 events (28%) in which several conspecifics participated, and only 12 (9%) that involved non-conspecific allies. Individual mobbing was mainly performed when the mobbed bird was in flight (56 events, 43%) rather than perched (26 events, 20%), and group mobbing was more common when the mobbed bird was perched (35 events, 27%) rather than in flight (14 events, 10%). This tendency to mob individually when the enemy was flying but mob in a group when the enemy was perched was statistically significant ($\chi^2 = 18.191$, $P < 0.05$, $df = 1$). Mobbing served an anti-predatory function in most observations (109 mobbing events, 83%). Nonetheless, mobbing was also performed for food resource protection in 17 events (13%), and site defense in five events (4%). Sixteen species (53%) were observed exhibiting mobbing behavior during the breeding season (75 mobbing events, 58%). Most mobbing events (98%) were initiated by the weaker species. Mobber and mobbed species differed significantly in body size (Wilcoxon Signed-rank Test $W = 4471.0$; $P < 0.05$) and body mass (Wilcoxon Signed-rank Test $W = 4452.5$; $P < 0.05$). The body size ratio of mobber to mobbed species ranged from 1:0.8 (Sooty-capped Hermit *Phaethornis augusti*: House Wren *Troglodytes aedon*) to 1:5.6 (Blue-tailed Emerald *Chlorostilbon mellisugus*: Roadside Hawk). Likewise, body mass ratio ranged between 1:1 (Roadside Hawk *R. magnirostris*: Crested Oropendola *Psarocolius decumanus*) and 1:117.5 (White-vented Plumeleteer *Chalybura buffonii*: Crested Caracara *Caracara plancus*). In general, a mobber engaged in mobbing against other birds of similar or larger body size (up to 5.6 times larger) or larger body mass (up to 117.5 times heavier). In most mobbing events (54%) a mobber attacked birds that doubled it in size, and in 75% of the events, the mobbed bird was three times heavier than the mobber. Noteworthy body size and mass ratios were found between members of Trochilidae and raptors (Supplementary Materials 1). Eight mobber species (26%) were also mobbed: the White-vented Plumeleteer, the Tropical Kingbird, the Great Kiskadee, the Southern Rough-winged Swallow *Stelgidopteryx ruficollis*, the Pale-breasted Thrush *Turdus leucomelas*, the Tropical Mockingbird, the Blue-gray Tanager *Thraupis episcopus*, and the Crested Oropendola. Descriptions of the recorded bird-to-bird mobbing events follow:

Table 1. List of the 31 bird species recorded performing mobbing behavior in northern Venezuela. Data include number of mobbed species and mobbing events, number of records during the breeding season, mobbing tactic and function. Mobbing tactic: Individual (IND); Conspecific (CON); Interspecific (INT). Mobbing function: Anti-predatory (ATP); Site defense (STD); Food resource protection (FRP).

| Mobber species | N° mobbed species | N° mobbing events | Records during breeding season | Mobbing tactic | Mobbing function |
|--|-------------------|-------------------|--------------------------------|----------------|------------------|
| Ardeidae | | | | | |
| ¹ <i>Bubulcus ibis</i> | 1 | 1 | - | IND | ATP |
| Accipitridae | | | | | |
| ¹ <i>Rupornis magnirostris</i> | 2 | 5 | 4 | IND | ATP, STD |
| Falconidae | | | | | |
| <i>Falco femoralis</i> | 1 | 1 | - | IND | STD |
| Charadriidae | | | | | |
| <i>Vanellus chilensis</i> | 1 | 1 | - | CON | ATP |
| Psittacidae | | | | | |
| ¹ <i>Psittacara wagleri</i> | 1 | 1 | - | CON | ATP |
| Trochilidae | | | | | |
| ¹ <i>Phaethornis augusti</i> | 2 | 2 | 2 | IND | FRP |
| ¹ <i>Chlorostilbon mellisugus</i> | 2 | 2 | - | IND | ATP, STD |
| ¹ <i>Chalybura buffonii</i> | 1 | 1 | - | IND | ATP |
| <i>Leucippus fallax</i> | 3 | 3 | - | IND | ATP |
| <i>Saucerottia tobaci</i> | 11 | 11 | - | IND | ATP, STD, FRP |
| ¹ <i>Colibri delphinae</i> | 4 | 7 | - | IND | FRP |
| Picidae | | | | | |
| ¹ <i>Picumnus squamulatus</i> | 1 | 1 | 1 | IND, CON | ATP |
| ¹ <i>Campephilus melanoleucos</i> | 1 | 1 | 1 | IND, CON | ATP |
| Furnariidae | | | | | |
| <i>Phacellodomus rufifrons</i> | 1 | 1 | 1 | CON | ATP |
| Tyrannidae | | | | | |
| <i>Tyrannus melancholicus</i> | 14 | 20 | 14 | IND, CON, INT | ATP |
| <i>Pitangus sulphuratus</i> | 5 | 6 | 4 | IND, CON, INT | ATP, FRP |
| <i>Myiodynastes maculatus</i> | 4 | 5 | 4 | IND, CON, INT | ATP |
| <i>Megarynchus pitangua</i> | 2 | 7 | 5 | IND, CON | ATP |
| <i>Myiozetetes similis</i> | 4 | 5 | 4 | IND, CON, INT | ATP |
| ¹ <i>Myiozetetes cayanensis</i> | 4 | 8 | 8 | IND, CON, INT | ATP |
| <i>Phaeomyias murina</i> | 2 | 3 | 2 | IND | ATP |
| <i>Elaenia flavogaster</i> | 1 | 1 | 1 | IND | ATP |
| Corvidae | | | | | |
| ¹ <i>Cyanocorax yncas</i> | 2 | 2 | - | CON | ATP |
| Hirundinidae | | | | | |
| <i>Stelgidopteryx ruficollis</i> | 1 | 1 | - | CON | ATP |
| Turdidae | | | | | |
| <i>Turdus leucomelas</i> | 4 | 6 | 3 | IND, CON, INT | ATP, FRP |
| ¹ <i>Turdus nudigenis</i> | 3 | 3 | 3 | IND, CON | ATP |
| Mimidae | | | | | |
| <i>Mimus gilvus</i> | 4 | 6 | 4 | IND, CON | ATP |
| Thraupidae | | | | | |
| <i>Thraupis episcopus</i> | 4 | 6 | 5 | IND, INT | ATP, FRP |
| ¹ <i>Sporophila nigracollis</i> | 4 | 4 | 4 | IND | ATP |
| Icteridae | | | | | |
| ¹ <i>Psarocolius decumanus</i> | 4 | 6 | 6 | IND, CON | ATP |
| <i>Quiscalus lugubris</i> | 3 | 3 | - | IND, CON | ATP |

¹No previous records of mobbing behavior based on Cherrie (1916), Meyer de Schauensee & Phelps (1978), Sick (1993), Hilty (2003), Fitzpatrick (2004), Motta-Junior (2007), Castro-Siqueira (2010), Sandoval & Wilson (2012), De la Ossa et al. (2018), Lima et al. (2018), and Terife & Lentino (2018, 2019).

(-) Breeding condition (nest presence/birds carrying nest material) unknown.

Cattle Egret *Bubulcus ibis*. A Cattle Egret was recorded mobbing a Common Black Hawk *Buteogallus anthracinus* in flight; it attempted to peck the raptor's head twice. The hawk quickly plummeted to avoid the attack and the egret returned to its original location.

Roadside Hawk *Rupornis magnirostris*. When a Common Black Hawk occupied the usual Roadside Hawk's hunting spot, the latter flew in a circle around the enemy while uttering a series of annoying "kee-kee-kee" notes. Suddenly, it threw itself towards the Common Black Hawk almost touching its head. The Common Black Hawk ducked its head, tilted its posture, and left the site after three identical attack rounds. On three separate occasions, the Roadside Hawk mobbed the Common Black Hawk, trying to peck its head, back, or tail (30–70 m) in flight. On one of these occasions, the Roadside Hawk was exposed to real danger when the Common Black Hawk suddenly counter-attacked turning around and quickly extending one leg, still upside down, in an attempt to catch the mobber. The Roadside Hawk had to plummet to escape. In addition, the Roadside Hawk mobbed a Crested Oropendola when a male perched near the hawk's nest. The Roadside Hawk emerged from a nearby tree flying towards the intruder, flapping its wings continuously while uttering the "kee-kee-kee" notes. When the hawk was in striking distance of the oropendola, it suddenly diverted its route without touching the bird. A moment before, the Crested Oropendola had already flown away.

Aplomado Falcon *Falco femoralis*. An Aplomado Falcon mobbed a Crested Caracara *Caracara plancus* when it occupied the falcon's usual hunting spot. The falcon soared around the caracara uttering a series of annoying "ke-ke-ke" notes. Suddenly, it threw itself towards the Crested Caracara, almost touching its back. Despite the attack, the caracara ignored it, ducked its head, tilted its body, and after six attack rounds the caracara finally flew away.

Southern Lapwing *Vanellus chilensis*. The mobbing event occurred at fledgling time when a group of three adults and a small juvenile were around a pond and a Little Blue Heron *Ardea caerulea* landed. Immediately, one of the adult Southern lapwings flew toward the heron with wings raised, displaying its red wing spurs, uttering several shrills and loud "kee-kee-kee" notes. Since the Little Blue Heron ignored the threatening display, the other two adult individuals joined the mobbing event, performing the same display until definitely expelling the heron.

Scarlet-fronted Parakeet *Psittacara wagleri*. A noisy flock of 40 Scarlet-fronted parakeets was flying when they noticed a Crested Caracara flying in the opposite direction approximately 80 m away. The entire flock diverted its route toward the caracara, which quickly lost altitude and flew in a different direction to avoid the imminent attack.

Sooty-capped Hermit *Phaethornis augusti*. A Sooty-capped Hermit mobbed a House Wren that was foraging in a Heliconiaceae bush. The hermit flew up-and-down and side-to-side in

front of the wren while uttering a couple of "chip" warning notes. Since the wren ignored the display, the hermit suddenly attacked it, even pecking its nape feathers. Then, the wren flew away while being chased by the hummingbird for about 10 m. On a separate occasion, a Sooty-capped Hermit mobbed a Southern Rough-winged Swallow that was flying over a pastureland where the hermit was exploring the spikes of grasses in search of tiny flower-visiting insects. When the Southern Rough-winged Swallow flew over the hermit's foraging area, the hummingbird visually monitored the swallow's movements while flying steadily over the pastureland, and uttered several "chip" warning notes. After a few seconds, the hermit suddenly attacked the swallow and chased it approximately 10 m, almost touching it. Then, the hermit went back to the foraging patch, expecting the return of the swallow. When the swallow came back for a second time, the hermit chased and pecked the swallow's tail. Then, the Southern Rough-winged Swallow quickly disappeared.

Blue-tailed Emerald *Chlorostilbon mellisugus*. A Blue-tailed Emerald was recorded chasing a Roadside Hawk in flight. The pursuit was quite short (approximately 10 m) before the hummingbird perched on a twig, raising and lowering its crown feathers while uttering a series of squeaky notes. A separate event occurred when a Swallow Tanager *Tersina viridis* perched on a twig of *Verbesina caracasana*. This spot was regularly used by the hummingbird to catch insects that visited the *Verbesina* flowers, a strategy also used by the Swallow Tanager. Once the tanager was perched on the twig, the hummingbird attacked it with short darting flights while uttering squeaky sounds, almost pecking the tanager's head. After three attack rounds, the Swallow Tanager left the site.

White-vented Plumeleteer *Chalybura buffonii*. When a White-vented Plumeleteer was feeding on *Musa paradisiaca*'s flowers, a Crested Caracara perched on the same tree. The hummingbird approached the caracara with three short flights and then flew up-and-down in front and behind it uttering "chip" notes. Since the caracara completely ignored the display, the hummingbird attacked it almost pecking its head. Next, the hummingbird steadily flew in front of the caracara moving forward and backwards, and a few seconds later repeated the attack. Five attack rounds were needed to oust the Crested Caracara.

Buffy Hummingbird *Leucippus fallax*. This hummingbird was mostly observed mobbing in flight (66%, N = 3). While a Buffy Hummingbird was perched on a twig, a Yellow-headed Caracara settled on a cactus approximately 15 m away. Instantly, the hummingbird flew aggressively towards the caracara with darting flights around its head, accompanied by squeaky "chip" notes. The hummingbird was so aggressive and insistent that the caracara left the site in less than a minute, with the hummingbird chasing it for about 50 m. Then, the hummingbird returned to its perch, raising and lowering its crown feathers. Later, an American Kestrel *Falco sparverius* approached the same tree while patrolling the area. The Buffy Hummingbird became restless, uttering continuous "chip" notes and visually following the kestrel's movements. As soon

as the kestrel was within 10 m of the hummingbird, this little bird attacked it trying to peck the kestrel's head and back. Instantly, the American Kestrel diverted its route being chased by the hummingbird for 20 m. On a third occasion, a Tropical Mockingbird was intensely attacked when it simply tried to perch on the same tree as the hummingbird; the mockingbird was chased for 10 m.

Brown Violetear *Colibri delphinae*. These mobbing events occurred when the Brown Violetear defended an artificial feeder. From a twig nearby the feeder, this hummingbird intensely attacked most potential enemies in flight (86%, N = 7) with noisy and darting flights. Two or three attack rounds were needed to expel a Sparkling Violetear *Colibri coruscans*, a White-vented Plumeleteer and a Bananaquit *Coereba flaveola*. The Brown Violetear also mobbed a Silver-beaked Tanager *Ramphocelus carbo* that was flying close to the feeder. The tanager ignored four attack rounds until the hummingbird pecked its head.

Copper-rumped Hummingbird *Saucerottia tobaci*. This tiny hummingbird ferociously defended itself and its feeding territories (blossom trees) from any of the mobbed species (Supplementary Materials 1) that came close. Most mobbing events (64%, N = 11) occurred with the mobbed bird in flight. The Copper-rumped Hummingbird needed 2–6 attack rounds to successfully expel larger hummingbirds such as the Black-throated Mango *Anthracothorax nigricollis* and up to 20 for expel large raptors such as the Short-tailed Hawk *Buteo brachyurus*. This hummingbird seemed to consider any other bird that approached its foraging tree as a potential enemy, no matter how large or whether it was a raptor or not.

Scaled Piculet *Picumnus squamulatus*. When a Lineated Woodpecker *Dryocopus lineatus* arrived on the Scaled Piculet's nest tree, a male piculet immediately flew from a nearby tree and perched aggressively close to the woodpeck-

er, with the crown feathers raised and uttering squeaky voices. Since the woodpecker totally ignored him, the piculet attacked it with darting flights, even pecking the woodpecker's tail. Suddenly, the female piculet emerged from the nest to join the attacks. After a few seconds, the Lineated Woodpecker left the tree.

Crimson-crested Woodpecker *Campephilus melanoleucos*. A Crimson-crested Woodpecker mobbed a Crane Hawk *Geranospiza caerulescens* when it arrived on the woodpecker's nest tree. The female inside the nest quickly noticed the hawk's presence and uttered a set of "churr... churr... churr" calls. Immediately, the male arrived from a nearby tree and approached the hawk aggressively with the crown feathers raised, engaging in forward-backward head movements, and uttering loud sounds. After a few side-to-side movements, the woodpecker attacked the hawk, pecking it strongly on the back and tearing off several feathers. The Crane Hawk instantly flew away.

Rufous-fronted Thornbird *Phacellodomus rufifrons*. A mobbing event was recorded when a Roadside Hawk perched next to an active Rufous-fronted Thornbird's nest. Instantly, one thornbird arrived restless, raising and lowering the crown feathers while uttering a series of hurried and loud "pit pit pit" trills. This call drew the attention of its mate who quickly joined the display. Jumping from one branch to another, both individuals slowly approached the raptor and surrounded it, continuously uttering their loud calls. Although the hawk obviously noticed the duet, it ignored them. Suddenly, one of the thornbirds attacked the hawk from behind trying to touch the raptor's head. When the hawk turned its head around, the second individual attacked it too. The Roadside Hawk left the site being chased by the two thornbirds trying to peck its head and back for approximately 50 m. Then, both Rufous-fronted Thornbirds returned and perched on the nest uttering their loud calls for at least 30 minutes.



Figure 1. A Tropical Kingbird *Tyrannus melancholicus* mobbing a juvenile Lesser Yellow-headed Vulture *Cathartes burrovianus* in Pueblo Nuevo, Península de Paraguaná, Falcón state, northern Venezuela. Photo author: Peter Wezel.



Figure 2. A Tropical Kingbird *Tyrannus melancholicus* chasing (left) and riding (right) a Yellow-headed Caracara *Milvago chimachima* in a mobbing event recorded in La Viña, Valencia city, Carabobo state, northern Venezuela. Photos author: Oswaldo Hernández.

Tropical Kingbird *Tyrannus melancholicus*. Although the Tropical Kingbird can mob alone (Figures 1 and 2), most mobbing events (55%, N= 20) were in group. Two or three individuals were needed to mob Turkey vultures *Cathartes aura*, Common Black hawks, White-tailed hawks *Geranoaetus albicaudatus*, Roadside hawks, Gray-headed kites *Leptodon cayanensis*, Yellow-headed caracaras, and Crested oropendolas. On two occasions, Tropical kingbirds were accompanied by a Rusty-margined Flycatcher *Myiozetetes cayanensis*, and once by a Great Kiskadee to mob a Yellow-headed Caracara. Most mobbing events (95%, N = 20) occurred when the enemy was in flight. When a potential enemy (Supplementary Materials 1) approached the Tropical Kingbird's nest, the flycatcher became restless, raising and vibrating its wings while uttering a series of "e'e'e'... e'e'e'... e'e'e'" trills. The kingbird then flew toward the enemy and tried to peck its head or wings or tail, and even rode on the enemy's back (Figure 2). When a couple of kingbirds performed the attacks, both individuals switched their offensive positions over the entire chase (50–300 m). The mobbed bird usually ducked its head, lost balance, and diverted from its original route. Tropical kingbirds also mobbed a Crested Oropendola when it arrived close to the kingbird's nest tree. Immediately, two kingbirds thrust themselves toward the oropendola performing bill clattering sounds and darting flights while almost touching it. After a few seconds, the oropendola left the tree. On one occasion, a Tropical Kingbird was exposed to true danger: a Common Black Hawk counter-attacked the kingbird turning around and extending one leg, still upside down, in an attempt to catch it.

Great Kiskadee *Pitangus sulphuratus*. While the Great Kiskadee can mob alone, two individuals were needed to mob Common Black hawks, Crane hawks, and Yellow-headed caracaras. Only one mobbing event occurred with the mobbed bird in flight. When a potential enemy (Supplementary Materials 1) perched near the kiskadee's nest, an individual uttered the raucous and loud "dee... dee... kis-ka-dee" calls to alert its mate. Then, both individuals settled 2–5 m in front of the enemy flapping their wings while uttering a series of single "dee... dee..." calls. Suddenly, one kiskadee attacked the

enemy with swooping flights and bill clattering sounds almost touching the bird, and then perched on another equidistant branch. Next, the second individual carried out a similar attack and perched next to its partner again. Two to five continuous attacks were needed to drive each enemy away. Mobbed birds usually ducked their head, lost balance, or jumped to a close branch before leaving the area. After each attack round, the Great Kiskadee flapped its wings and uttered the loud calls. Once, these calls drew the attention of a Tropical Kingbird who joined the Great Kiskadee to mob a Yellow-headed Caracara. On two occasions, the Great Kiskadee mobbed a Crested Oropendola to secure food for their offspring. Oropendolas were vigorously attacked when perched on an artificial fruit feeder frequently visited by kiskadees' juveniles. Adult kiskadees attacked the oropendolas as described above. When the oropendolas left the area, the juvenile kiskadees appeared and took advantage of the fruits left behind.

Streaked Flycatcher *Myiodynastes maculatus*. Most of the Streaked Flycatcher's mobbing events (60%, N = 5) were performed in groups. Two or three individuals were needed to mob the Roadside Hawk and the Yellow-headed Caracara. Only two mobbing events (40%, N = 5) occurred with the enemy in flight. When a potential enemy (Supplementary Materials 1) perched near the flycatcher's nest, an individual uttered the typical "chup wee wee, chup wee wee" calls. Then, the same individual flew forward and backwards toward the enemy at least twice. Next, a second (or even a third) individual joined the mobbing event and all together they surrounded the enemy. Then, one flycatcher attacked the enemy in a manner similar to that described for the Great Kiskadee. Before and after each attack, all individuals nervously flapped their wings and uttered their calls. Sometimes, these calls drew the attention of other birds such as Social Flycatchers *Myiozetetes similis* and Blue-gray tanagers. Both species once helped a Streaked Flycatcher to mob a Crested Oropendola as all three species were breeding in the same area at the same time. Additionally, a single Blue-gray Tanager once joined a Streaked Flycatcher couple mobbing a Yellow-headed Caracara.

Boat-billed Flycatcher *Megarynchus pitangua*. The Boat-billed Flycatcher mainly mobbed alone but two individuals were needed to mob the Roadside Hawk. The mobbed bird was in flight during six mobbing events (86%, N = 7). In general, the Boat-billed Flycatcher, from a treetop, noticed each potential enemy approaching from far away. Immediately, it uttered a series of nasal “*nya-nya-nya*” calls and flew fast and straight toward the enemy with bill clattering sounds and tried to touch the intruder’s head, wings and/or tail. The mobbed bird usually ducked the head, lost balance, and changed its route. This flycatcher frequently chased the enemy over a long distance (300–500 m).

Social Flycatcher *Myiozetetes similis*. Most of the Social Flycatcher mobbing events (60%, N = 5) occurred in groups. Two or three individuals were needed to mob Yellow-headed caracaras and Crested oropendolas. This flycatcher attacked its enemy in flight (60%, N = 5) trying to touch the head, wings or tail while chasing the enemy over a long distance (around 300 m). On two occasions, this flycatcher mobbed the Yellow-headed Caracara in a manner similar to that described for the Great Kiskadee. Once, a Social Flycatcher pair needed 22 attack rounds to oust a Yellow-headed Caracara.

Rusty-margined Flycatcher *Myiozetetes cayanensis*. Although the Rusty-margined Flycatcher can mob alone, two or three individuals were needed to mob Roadside hawks, Short-tailed hawks, Yellow-headed caracaras and Crested oropendolas. The mobbed bird was in flight during four mobbing events (50%, N = 8). When a potential enemy (Supplementary Materials 1) perched near the Rusty-margined Flycatcher’s nest, an individual uttered the typical alarm calls. Then, a second or even a third individual joined and all slowly approached the enemy, surrounding it. Suddenly, one individual attacked the enemy as described for the Great Kiskadee. Two to five attacks were needed to drive enemies away. Once, a Yellow-headed Caracara seemed to ignore the flycatcher attacks but a Tropical Kingbird joined the mobbing event and they drove the raptor away. A similar event involving a Roadside Hawk, instead of a caracara, occurred at a different time. In addition, Crested oropendolas were mobbed twice in flight by a single Rusty-margined Flycatcher.

Mouse-colored Tyrannulet *Phaeomyias murina*. The Mouse-colored Tyrannulet became restless, moving from one branch to another and raising its crown feathers, when it noticed an enemy’s presence (Supplementary Materials 1). Then, the tyrannulet flew vigorously towards the foe bird (which was usually flying) and tried to peck its head, wings, or tail. Mobbed birds diverted their routes and were usually chased by the tyrannulet for 10–15 m.

Yellow-bellied Elaenia *Elaenia flavogaster*. On one occasion, a Yellow-bellied Elaenia mobbed a Crested Oropendola when it arrived on the elaenia’s nest tree. One elaenia individual flew from a nearby bush and perched aggressively close to the oropendola (approximately 4 m) with its crown feathers raised and uttering a series of short, hoarse, and harsh whistles. After a few seconds, the elaenia attacked the potential

enemy, almost pecking its head, and consequently the Crested Oropendola flew away.

Green Jay *Cyanocorax yncas*. When a group of four Green jays was foraging in the forest canopy, an individual spotted a Double-Toothed Kite *Harpagus bidentatus* perched on a nearby tree and uttered a harsh call drawing the attention of the other three jays. Once the kite was detected by the entire group, they slowly moved toward the raptor uttering harsh calls and surrounding it. When the flock was two meters away, the Double-Toothed Kite left the site and avoided the imminent attack. A similar event occurred with a group of seven Green jays but the mobbed bird was a Groove-billed Toucanet *Aulacorhynchus sulcatus*.

Southern Rough-winged Swallow *Stelgidopteryx ruficollis*. A group of five Southern Rough-winged swallows mobbed a Roadside Hawk perched next to a pastureland where the swallows regularly flew. The swallows surrounded the raptor flying in a circular/sigmoidal aerial pattern. Suddenly, one swallow threw itself toward the hawk from behind almost touching its head and returning immediately to the flock. When the hawk turned its head around, another swallow repeated the same attack. The Roadside Hawk ducked its head and looked around in all directions. When a third individual attacked it, the hawk flew away.

Pale-breasted Thrush *Turdus leucomelas*. Although the Pale-breasted Thrush can mob alone, most mobbing events (67%, N = 6) were performed in groups. A male and a female were needed to mob the Roadside Hawk and the Yellow-headed Caracara. A non-conspecific ally, the Blue-gray Tanager, was also needed to successfully mob a Crested Oropendola. When raptors (Supplementary Materials 1) approached the Pale-breasted Thrush’s nest, the male uttered a series of harsh and loud “*reep reep reep*” notes that warned the female in the nest. Then, the restless male flew from one branch to another in front of the adversary (approximately 5 m), with the nape and crown feathers raised, and continuously uttered alarm notes. A few minutes later, the female joined the display and the couple flew around the enemy continuing their alarm calls. Despite the display, the raptor ignored the thrushes until the female swooped toward the enemy almost touching it. After these attacks, the birds of prey ducked their heads and visually tracked the mobber’s position. Taking advantage of the enemy’s distraction, the male strongly attacked it from behind, touching its nape or back. Two to three attacks were needed to drive raptors away. A mated pair of thrushes similarly mobbed a Crested Oropendola, a raptor-shaped bird who approached a young Pale-breasted Thrush. The oropendola ignore the thrushes, but was driven away after a Blue-gray Tanager joined the mobbing. A Crested Oropendola and a Rufous-vented Chachalaca *Ortalis ruficauda* were also vigorously attacked when they visited an artificial fruit feeder frequently used by the Pale-breasted Thrush. The male thrush displayed and attacked the birds as described above but did so alone. Although the Crested Oropendola flew away after two attack rounds, the Rufous-vented Chachalaca tolerated 11 attacks before leaving.

Spectacled Thrush *Turdus nudigenis*. The Spectacled Thrush mobbed in the same way as the Pale-breasted Thrush: a female and male mobbed raptors together whereas the male mobbed the Crested Oropendola alone. However, on one occasion, three Spectacled thrushes mobbed a Gray-lined Hawk *Buteo nitidus*. The third individual was probably a second male from a nearby nest. In that event, the hawk was surrounded by all three individuals who continuously uttered a series of squeaky and sharp notes. The thrushes took turns attacking the hawk every 40–70 seconds. After six minutes of continuous attacks, the Gray-lined Hawk left the site with one thrush chasing it for approximately 300 m.

Tropical Mockingbird *Mimus gilvus*. Although the Tropical Mockingbird can mob alone (Figure 3), two or three individuals were needed to chase away Crested and Yellow-headed caracaras. Only two mobbing events (33%, N = 6) occurred with the enemy in flight. The Tropical Mockingbird usually detected potential enemies from far away and immediately uttered a “jeop” alarm note followed by a series of squeaky and sharp calls. The alarms drew the attention of other nearby mockingbirds and heterospecifics such as the Tropical Kingbird and the Great Kiskadee. Next, a single mockingbird flew several times in a short round pattern toward the enemy while keeping a safe distance (around 25 m). Then, a second or third individual joined the mobbing event. Tropical mockingbirds individually or collectively approached the enemy and surrounded it. Suddenly, a mockingbird attacked with a straight and fast flight from behind (Figure 3), even touching the enemy with the feet or the bill. During group mobbing events, each

individual took a turn to attack the enemy, always doing it from behind. The mobbed bird ducked its head, lost balance or jumped to a nearby branch. Two to five attack rounds were needed to drive raptors away, and eight were needed in the case of a Cocoli Heron *Ardea cocoi*. After the enemies left, they were vigorously chased by one to three mockingbirds (100–300 m) who continuously tried to peck the head, wings, or tail of the enemy.

Blue-gray Tanager *Thraupis episcopus*. On two separate occasions, a Blue-gray Tanager vigorously chased a Crested Oropendola and a Rufous-vented Chachalaca when they flew through the tanager’s breeding area. In flight, the tanager tried to touch the head and back of both species of birds. The oropendola ducked its head, lost balance, and reoriented its route. The chachalaca, however, totally ignored the tanager attack and arrived on a perch. On a third occasion, a Blue-gray Tanager attacked a Squirrel Cuckoo *Piaya cayana*, with a straight and fast flight from behind, that was foraging on the tanager’s nesting tree. The cuckoo withdrew after a single attack. In addition, the Blue-gray Tanager mobbed a Tropical Kingbird on an avocado tree bloom. This spot was usually used by both species to catch insects that visited the avocado flowers, an important protein source for the tanager’s nestlings. Two strong attack rounds were needed to oust the flycatcher. Finally, the Blue-gray Tanager was also observed responding to the alarm calls of the Streaked Flycatcher and the Pale-breasted Thrush and helping them to mob Crested oropendolas.



Figure 3. A mobbing sequence performed by the Tropical Mockingbird *Mimus gilvus* against the Crested Caracara *Caracara cheriway* in Pueblo Nuevo, Península de Paraguaná, Falcón state, northern Venezuela. Photos author: Peter Wezel.

Yellow-bellied Seedeater *Sporophila nigricollis*. The Yellow-bellied Seedeater vigorously defended its breeding area. Once a potential enemy (Supplementary Materials 1) was spotted, the seedeater attacked it with a strong and fast flight while trying to peck the mobbed bird before it reached the nesting tree. On one occasion, this seedeater even managed to tear a small feather from a House Wren.

Crested Oropendola *Psarocolius decumanus*. Although the Crested Oropendola can mob alone, two individuals were needed to mob the Common Black Hawk and the Yellow-headed Caracara. The enemy was in flight during five mobbing events (83%, N = 6). When any of the raptors (Supplementary Materials 1) approached the Crested Oropendola's colony, the alpha male uttered a very loud and hollow "chac-chac-chac" alarm call. This sound not only alerted the raptors about the oropendola's presence but also alerted other members of the colony about a potential danger. Other bird species that temporarily visited the same tree fled quickly after hearing the oropendola alarm call. Raptors usually ignored the signal and the Crested oropendolas attacked them in a single, straight, and loud (due to the flapping noise) flight, almost touching the flying raptors. Enemies immediately diverted their routes in response to this attack. On two occasions, a second oropendola accompanied the leading mobber. This second individual usually chased the birds of prey (approximately 100 m) after they changed course. On one occasion, a young Yellow-headed Caracara arrived at the colony tree and immediately was vigorously attacked by two oropendolas; it flew away.

Carib Grackle *Quiscalus lugubris*. All mobbing events occurred when a flock (males, females and fledglings) visited a water source during the dry season. The group usually explored the grass around the site even when other bird species were there. Occasionally, a raptor (Supplementary Materials 1) perched close to the flock perhaps attracted by the fledglings or by the water source. Once the raptor was perched, one or two male grackles flew and stood in front of it (\pm 5m) uttering loud, ringing, and bouncy "queek-queek-queek-queek" notes. Suddenly, one male attacked the enemy in a straight flight from behind, almost touching its head. A second male could follow it almost immediately. Mobbed species ducked their heads and lost balance. In the interim, the other grackles continued uttering their loud calls while approaching the potential enemy. Once surrounded, the raptor moved away before another attack occurred. Only the Black Vulture *Coragyps atratus* needed the combined effort of five grackles in three attack rounds to be expelled.

DISCUSSION

The mobbing events described in this study represent new observations of this behavior in Venezuelan species and add to our knowledge of birds that perform mobbing in this country. I recorded mobbing events for 31 species and 15 families, and have provided comprehensive case-by-case descriptions of this behavior in these Neotropical birds. In addition, for species with previous records of mobbing such as the Southern Lapwing, Copper-rumped Hummingbird (Hilty 2003), Trop-

ical Kingbird (Cherrie 1916, Sick 1993, Meyer de Schauensee & Phelps 1978, Hilty 2003), Boat-billed Flycatcher, Great Kiskadee (Meyer de Schauensee & Phelps 1978, De la Ossa et al. 2018) and Southern Rough-winged Swallow (Sick 1993), this work also provides new information about the species that were mobbed. Although mobbing behavior had been documented in 17 species, for some like the Rufous-fronted Thornbird, Streaked Flycatcher, Social Flycatcher, Mouse-colored Tyrannulet, and Blue-gray Tanager this behavior was only known by their responses to predator playbacks (Sandoval & Wilson 2012, Lima et al. 2018). Thus, mobbing in response to natural predator encounters was confirmed for all of them in this work. Likewise, for the Carib Grackle, a bird recognized for its agonistic attitude toward cats, dogs, and humans (Restall et al. 2006, Jaramillo & Burke 1999), I provide records of bird-to-bird mobbing. Numerous cases of mobbing behavior remain overlooked in the ornithological literature as descriptions of hostile actions between birds. Examples of this include the Olive Oropendola *Psarocolius bifasciatus* being chased by Scarlet macaws *Ara macao* in Venezuela (Rodríguez-Ferraro 2006), as well as Southern Rough-winged swallows chasing a Great Kiskadee, and swarms of the Blue-and-white swallows *Pygochelidon cyanoleuca* flying around hawks in Brazil (Sick 1993). These hostile actions were never reported as mobbing behavior, which highlights the need for more studies focusing on mobbing in the neotropics.

In this study, Tyrannidae included the highest number of species (N = 8) that performed mobbing, followed by Trochilidae (N = 6). At the species level, Tropical kingbirds mobbed the most species (N = 14) followed by the Copper-rumped Hummingbird (N = 11). Since many members of Tyrannidae and Trochilidae are well-known for their pugnacious behavior (Meyer de Schauensee & Phelps 1978, Tyrrell & Tyrrell 1985, Schuchmann 1999, Fitzpatrick 2004, Mayntz 2019) and their intolerance toward raptors or raptor-shaped birds (Meyer de Schauensee & Phelps 1978), these findings were unsurprising.

My observations indicate that individual mobbing was the most common tactic. This finding aligned with the fact that most mobbing events occurred when the enemy was in flight, and mobber birds tended to mob individually when the enemy was flying, compared to when it was perched. Without comparable previous studies, I can only infer that a mobber bird probably found the flight as a safer situation because an enemy focused on flying is less able to avoid external attacks. Thus, a lonely mobber is enough to expel it. Indeed, mobbers have been shown to adjust the intensity of their mobbing according to the perceived threat level of an enemy (Dutour et al. 2016).

When conducted in a group, mobbing events imply communication among individuals of the same or different species as pointed out by Hurd (1996) and Dutour et al. (2019). In this study, the Scaled Piculet, the Tropical Kingbird, the Streaked Flycatcher, the Pale-breasted Thrush and the Blue-gray Tanager were capable of recognizing and be attracted by the alarm calls of conspecifics or heterospecifics in order to cooperate in a mobbing event. Alarm calls between conspecifics and heterospecifics are common (Magrath et al. 2007, Fallow et al. 2013, Potvin et al. 2018) and they are considered to be the

main behavior involved in successfully attracting mobbers (Sternalski & Bretagnolle 2010).

My observations indicated that the most common mobbing function was anti-predatory defense, which was mainly carried out against raptor birds (Cathartidae, Accipitridae, Falconidae, Strigidae). In fact, raptors are known as the most consistent targets of mobbers (Dutour et al. 2016). However, according to Dow (1977), mobbing may serve other functions. Certainly, the Pale-breasted Thrush mob the Rufous-vented Chachalaca to defend a food resource (Verea et al. 2016). Some of the observed hummingbirds (Copper-rumped Hummingbird, Brown Violetear) impressively defended food resources (i.e., blossom trees, sugar-water feeders). Because a territorial and aggressive hummingbird may attack another bird no matter how large or whether it is a raptor bird or not (Mayntz 2019), mobbing behavior does not seem odd among Trochilidae species, and it has probably been underestimated. Small species tend to participate in mobbing behavior (Lima et al. 2018) and Trochilidae comprise the most important group of small birds in the Neotropics (Schuchmann 1999). On the other hand, a site that allows for clear visibility of an area (i.e., hunting spot) can greatly increase the chances of obtaining food for the Roadside Hawk and the Aplomado Falcon. I frequently observed Roadside hawks hunting from a *Cecropia* top, a strategic place that the Common Black Hawk occasionally occupied and from which it had to be expelled.

More than half of the mobbing events reported here were recorded during the breeding season which is a period particularly sensitive toward predators, and a high mobbing intensity is expected throughout this period (Altmann 1956, Curio et al. 1978, Smith & Graves 1978, Shedd 1983, Krams & Krama 2002). The percentage of birds that mobbed while breeding in this study was 58%, but the true percentage could be higher because the breeding condition of the mobbers was indeterminate in many cases. Dutour et al. (2019), however, observed a reverse pattern when studied responses of bird communities to the Eurasian Pygmy-Owl *Glaucidium passerinum*. Birds showed a higher response rate during juvenile dispersion (autumn) compared to the breeding season (spring) due to higher predation pressure (Dutour et al. 2019).

Most mobbing events were initiated by the weaker species and highly significant differences were found between the body size and body mass of mobber and mobbed species, a result that supports the claims originally made by Hartley (1950) and Altmann (1956). Recently, Hua & Sieving (2016) and Lima et al. (2018) also found that small-bodied birds are more likely to participate in mobbing events. In Paraguay, Smith (2006) observed that Great kiskadees only mobbed birds larger than themselves while smaller birds provoked no reaction. In this study, mobbers were larger than mobbed birds in only three cases (Sooty-capped Hermit vs. House Wren, Yellow-bellied Seedeater vs. House Wren, and Crested Oropendola vs. Roadside Hawk). Few similar situations have been previously reported. In Argentina, Shiny cowbirds *Molothrus bonariensis* were mobbed by Chalk-browed Mockingbirds *Mimus saturninus*, a species is twice as large as the cowbird (Gloag et al. 2013). Additionally, Blue-and-yellow macaws *Ara ararauna* and the Chestnut-fronted macaws *A. severus* have been ob-

served mobbing Peregrine falcons *Falco peregrinus* and Merlins *F. columbarius* in Venezuela (Terife & Lentino 2018, 2019).

Mobbing typically involves a non-predator bird and a predator. But predator-predator mobbing has not been frequently reported. Here, an Aplomado Falcon and a Roadside Hawk were documented mobbing a Crested Caracara and a Common Black Hawk, respectively. Previous records of predator-predator mobbing include the Aplomado Falcon and the Merlin against the Peregrine Falcon in Venezuela (Terife & Lentino 2018, 2019), the Yellow-headed Caracara mobbing the Turkey Vulture in Colombia (Cortés-Suárez 2021), the Chimango Caracara mobbing four other raptors in Brazil (Sick 1993), and four different raptors from North America mobbing the Golden Eagle *Aquila chrysaetos* (Broun 1947).

This study showed that members of species that are typically mobbed by others can also play the role of mobbers. For example, herons (Ardeidae) appear among typically mobbed species (Cornell Lab of Ornithology 2009) but the Cattle Egret behaved as a mobber in this study. Likewise, a Crested Oropendola mobbed a Roadside Hawk, a bird that predate on nests of Icteridae (Sick 1993), but a Roadside Hawk also mobbed a Crested Oropendola, a species that attack nests as well (Reidy 2009, Machado-Stredel et al. 2019).

A few of the observations reported here were difficult to explain because the mobbed bird did not seem to be a threat. Nonetheless, some of the mobbed species are recognized nest predators, such as species of Ramphastidae (Sick 1993, Hilty 2003). Among them, the Groove-billed Toucanet feed on eggs and nestlings in Venezuela (Wezel & Verea 2012) and the Green Jay mobbed it preventively. In Brazil, the Brown-chested Martin *Progne tapera* mobs the Chestnut-eared Aracari *Pteroglossus castanotis* when it is foraging close to the swallow's nest (Sick 1993). In some cases, the mobbed species resembles a predator in size and shape, such as the Rufous-vented Chachalaca, especially when gliding. Similarly, the Crested Oropendola was perceived as a threat by several birds and it was confronted by ten different bird species in this study. The mobbing of a Squirrel Cuckoo by a Blue-gray Tanager was likely because of the cuckoo's resemblance to a bird of prey, since some species of Cuculidae have evolved to trick other birds into thinking that they are predators (RSPB 2019). The same tanager forages for insects that visit flowers (Isler & Isler 1999), and it may mob the Tropical Kingbird because it considers it an important competitor that exploits the same food resources. Similarly, the Sooty-capped Hermit perceived the House Wren as an enemy when it was foraging around *Heliconia* bushes. Heliconiaceae flowers are an important food resource for *Phaethornis* species (Stiles 1985, Gill 1987) because, in addition of nectar, hermits also obtain small insects on these plants. Nonetheless, House wrens could be perceived as an enemy because they destroy the eggs of other birds (Kaufman 2020).

In my observations only two species, the Roadside Hawk and the Tropical Kingbird, were exposed to true danger when they tried to mob the Common Black Hawk, but both escaped unharmed. Some authors, however, have documented cases of mobbers killed by mobbed birds, including a Red-shouldered Hawk *Buteo lineatus* killed by a Golden Eagle (Broun

1947), an American Crow *Corvus brachyrhynchos* caught and killed by a Great Horned Owl *Bubo virginianus* (Denson 1979), and some *Tyrannus* species killed by Ferruginous Pygmy-owls *Glaucidium brasilianum* (Motta-Junior 2007).

The information collected during this study contributes to the available data on the mobbing behavior of wild birds worldwide, and noticeably improves our current knowledge of this behavior in Venezuela and the Neotropical region. These results provide new information on mobbing events including the moments of their occurrence, the number of birds involved, their function, and the size ratio between the mobber and mobbed species. Also, observations showed that several mobbed birds can behave as mobbers, and reveal that mobbing in birds is a very complex behavior, which has not yet been examined in depth. Future studies should explore other less obvious mobbing functions, and identify clear the behavioral variables that separate mobbing from similar behaviors.

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