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## Agonistic Interactions in Raptors of the Pampas Region

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**ABSTRACT.**—In this study, we evaluated the interspecific agonistic responses of raptors and non-raptors, elicited by the presence of five raptor species (*Circus cinereus*, *C. buffoni*, *Rupornis magnirostris*, *Elanus leucurus*, and *Geranoaetus melanoleucus*) in the Pampas region of Argentina. We registered 62 agonistic interaction events, most of them involving two raptor species (58%). During these events we registered 122 attacks, 10 persecutions, and three cases of kleptoparasitism. *Milvago chimango* was the most important aggressor species among raptors, and *Vanellus chilensis* among non-raptor birds. Attacks in groups were more frequently performed by non-raptors (61.5% of the events involved two or more aggressor individuals) than by raptors (68.5% of the events involved only one aggressor). This study represents a primary approach to one scarcely explored aspect of raptor behavior in southern South America. Received 20 November 2012. Accepted 7 April 2013.

Key words: aggressive behavior, Argentina, body size, diurnal raptors, dominance hierarchy.

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Agonistic interactions among birds occur when the interests of two or more individuals are in

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conflict. Among Falconiformes these interactions are usually related to the defense of hunting or breeding territories (Newton 1979). Such behaviors may be relatively non aggressive (e.g., posturing, flight displays; Jamieson and Seymour 1983), aggressive (e.g., persecutions, escorting flights, attacks; Bildstein and Collopy 1985), or a combination of both (Dawson and Mannan 1991). Since raptors are potential predators of nests and fledglings, agonistic interactions often involve not only other raptors, but also smaller non-raptors (Vasina and Straneck 1984, Saggese and De Lucca 2001, De Lucca 2011). Body size seems to be an important factor in determining agonistic behavior. Large-sized raptors tend to elicit more aggressive reactions than do smaller ones (Jiménez and Jaksic 1989, Liébana et al. 2009), which may be related to dominance hierarchies (large individuals are usually dominant over small ones; Yahner 2012). Individuals of smaller size species tend to associate during agonistic interactions in an attempt to disable or drive large predators from the vicinity of their nesting sites (Desrochers et al. 2002, Arnold et al. 2005).

In the southern cone of South America studies about agonistic interactions in raptors are scarce and, in most cases, they report information in relation to the reproductive behavior (Saggese and De Lucca 1995, 2001; De Lucca and Saggese

1996; Baladrón et al. 2006; Salvador-Jr. et al. 2008; Liébana et al. 2009; but see Jiménez and Jaksic 1989; De Lucca 2011). In this study, we describe the interspecific agonistic interactions of sympatric raptor and non-raptor species in the Pampas of Argentina, in order to evaluate relationships between the occurrence of this behavior and characteristics of the species involved. We expect to find that if body size is a key factor in determining agonistic behavior of birds in the study area: (1) the intensity of interactions should increase along with the size of the potential predator, and (2) small birds should display associative behavior to repel large raptors.

From 2005–2008, we documented the agonistic interactions of diurnal raptors in Mar Chiquita County, southeast Buenos Aires Province, Argentina (37° 32'–37° 45' S; 57° 19'–57° 26' W). The sampling was conducted in an opportunistic manner throughout the period (including reproductive and non reproductive seasons), as part of a broader project aimed to register the activity patterns of raptors that inhabit the study area. The area is located in the Pampas region and includes zones of native vegetation including marshes and grasslands, and zones of agriculturally-modified environments (mainly pasturelands) (Isacch 2008). We registered the response of raptors and non-raptors to the presence of five species of raptors (hereafter, target species): Cinereous Harrier (*Circus cinereus*), Long-winged Harrier (*C. buffoni*), Roadside Hawk (*Rupornis magnirostris*), White-tailed Kite (*Elanus leucurus*) and the Black-chested Buzzard-Eagle (*Geranoaetus melanoleucus*). All these species are mainly carnivorous, and show different abundances (AVB, unpubl. data), hunting modes (Bó et al. 2007), and body sizes (Ferguson-Lees and Christie 2001). The Cinereous and the Long-winged harriers are medium-sized raptors (~420 g and ~500 g, respectively), the first is considered as rare and the second as occasional; both harriers are active-search bird-eating predators (Baladrón et al. 2012). The Roadside Hawk is a medium-sized raptor (~315 g), whose abundance has increased in recent years at the study area (see Baladrón et al. 2011). The White-tailed Kite is a common small-medium raptor (~280 g) with a diet composed mainly of small mammals which are captured by hovering (Dunk 1995). The Black-chested Buzzard-Eagle is the biggest raptor of the target group (~2200 g) and is quite rare in the study area.

During each interaction event we registered the aggressor and target species, the number of individuals involved, the number and type of interaction (i.e., attacks: when the aggressor attempts to contact other individual using the bill or talons; kleptoparasitism: when the aggressor steals food from other individual; persecutions: when the aggressor expulses other individual from the area [without attacking]). In addition, we recorded the activity performed by target species during each interaction event (i.e., flying, feeding, perching, foraging [sit-and-wait or active search], and nest defense).

During the study period, the five target species elicited a total of 62 agonistic interaction events, most of them with other raptor species (58%), and the remaining with non-raptor species (Table 1). During these events, we registered 122 attacks, 10 persecutions, and three cases of kleptoparasitism. The Black-chested Buzzard-Eagle, the largest raptor of the target group, was the species that elicited more attack responses from other birds (28.7% of total attacks). The remaining interaction events were elicited mainly by the Long-winged Harrier and the Roadside Hawk (27% and 25.4%, respectively), and by the Cinereous Harrier (11.5%) and the White-tailed Kite (7.4%) (Table 1). The 50% of events involved the Chimango Caracara (*Milvago chimango*) and the Southern Caracara (*Caracara plancus*) as aggressor species.

Our results show that body size was important in determining agonistic responses, since more than 95% of the events involved a smaller bird harassing a larger one. The importance of body size may be related to the dominance hierarchy (Martínez et al. 2008, Yahner 2012), which entails that larger species are more often harassed by smaller ones (Jiménez and Jaksic 1989). Similar results have been observed for the Peregrine Falcon (*Falco peregrinus*), which frequently attack larger raptors (e.g., Southern Caracaras) but do not attack smaller ones (e.g., American Kestrel [*Falco sparverius*], White-tailed Kite, and Chimango Caracara) in central Argentina (Vasina and Straneck 1984). No relationship was evident between the frequency of attacks and the relative abundance of the target species, which may indicate that body size is more important than abundance in determining agonistic behavior.

Among raptors, the Chimango Caracara appeared as the most important species in stimulating interspecific agonistic interactions. This

TABLE 1. Agonistic interaction events between the five target raptor species and non-raptors in the southeastern Pampas of Argentina. Numbers indicate the sum of cases we registered for each type of interaction (attack-kleptoparasitism-persecution). n.d.: no data.

	Aggressor species				Target species				
	Common name	Scientific name	Mean weight (g)	n individuals	Roadside Hawk	Black-chested Buzzard-Eagle	Long-winged Harrier	Cinereous Harrier	White-tailed Kite
<i>Raptors</i>									
Chimango	Caracara	<i>Milvago chimango</i>	295	1	4-0-0	-	1-2-0	4-0-0	3-1-3
				2	-	3-0-0	-	-	-
				3	-	-	4-0-0	0-0-1	-
				5	-	-	-	4-0-0	-
				8	-	-	-	2-0-0	-
				14	-	-	-	0-0-1	-
Southern	Caracara	<i>Caracara plancus</i>	1,380	1	-	1-0-0	-	-	3-0-5
				3	-	1-0-0	-	-	-
				4	-	3-0-0	-	-	-
				5	-	5-0-0	-	-	-
American	Kestrel	<i>Falco sparverius</i>	117	1	23-0-0	-	-	-	-
<i>Non-raptors</i>									
Southern	Lapwing	<i>Vanellus chilensis</i>	310	1	-	-	5-0-0	-	-
				2	-	3-0-0	4-0-0	-	-
				3	-	2-0-0	5-0-0	-	-
				4	-	-	2-0-0	-	-
				5	-	16-0-0	-	-	-
Unidentified	passerines		n.d.	1	-	-	-	3-0-0	2-0-0
				2	-	-	2-0-0	-	-
Brown-and-yellow	Marshbird	<i>Pseudoleistes virescens</i>	75	1	-	-	2-0-0	-	-
				3	-	-	8-0-0	-	-
Great	Kiskadee	<i>Pitangus sulphuratus</i>	70	1	1-0-0	-	-	-	-
Chalk-browed	Mockingbird	<i>Mimus saturninus</i>	74	1	3-0-0	-	-	-	-
swallows			20	3	-	-	-	-	1-0-0
				20	-	-	-	1-0-0	-
Monk	Parakeet	<i>Myiopsitta monachus</i>	124	45	-	1-0-0	-	-	-
Total	Interactions				31-0-0	35-0-0	33-2-0	14-0-2	9-1-8

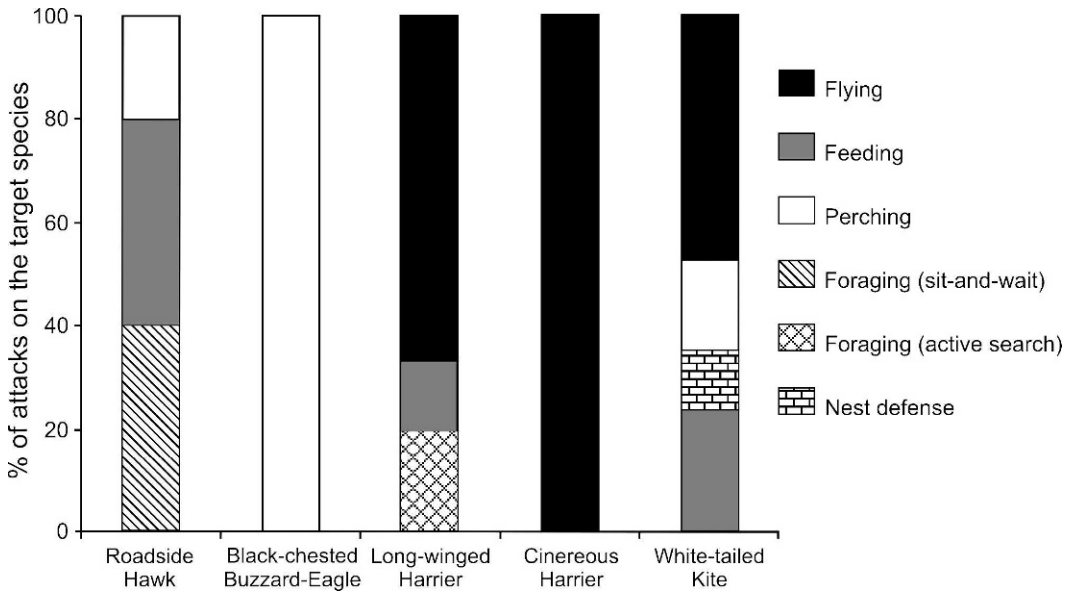


FIG. 1. Frequency of attacks on the target species for each activity type.

species performed the highest percentage of the total attacks (41%; Table 1), and was the only species that interacted with the five target species; it was also the most common receiver of interactions (see below). The Chimango Caracara shows the highest population density among raptors in the Pampas region (Ferguson-Lees and Christie 2001, Martínez 2001). Although the participation of this species is related to its abundance in the study area, we believe that it is also enhanced by the intrinsic behavioral traits of this raptor. For instance, it has been reported that this raptor may use alternative mechanisms to obtain food, such as kleptoparasitism (García and Biondi 2011) or mutualistic associations with larger raptors (Baladrón et al. 2009), which may be associated to agonistic behavior. Among non-raptors, the Southern Lapwing (*Vanellus chilensis*) was the most aggressive species, accounting for 60.7% of the total attacks on the target species (Table 1). The aggressive behavior of this species has been extensively reported (Saggese and De Lucca 2001, Baladrón et al. 2006, De Lucca 2011) and is related to the intensive efforts to keep intruders away from the nesting site.

Among non-raptors, most of the events (61.5%) involved two or more aggressor individuals (Table 1). This associative behavior, or mobbing, is a typical defense behavior of many gregarious

species (Arnold et al. 2005). This may be the case of the Brown-and-yellow Marshbird (*Pseudoleistes virescens*), which performed 43.5% of the attacks among passerines. This is a gregarious species that shows cooperative breeding (Mermoz and Reboreda 1998), and it is probable that the helpers participate in predator mobbing (Arnold et al. 2005). In contrast among raptors, most cases included one-by-one interactions (68.5% of the events; Table 1).

The activity type displayed by the target raptors showed low incidence on the generation of agonistic responses. For instance, the Black-chested Buzzard-Eagle and the Roadside Hawk were attacked while perching (i.e., searching for prey, feeding or resting); whereas, harriers were attacked mostly in flight (i.e., during cruising flights or searching for prey) (Fig. 1). In this sense, the frequency of attacks by activity type seemed to relate to the typical activity patterns of each species of the target group (Bó et al. 2007).

In addition, we registered 15 cases of reverse interaction (i.e., when target species harassed other birds), all of them involving two individual raptors. These events included persecutions ( $n = 11$ ) and attacks ( $n = 4$ ). The most frequent aggressor species was the White-tailed Kite (73.3% of the events), followed by the Cinereous

Harrier (20%), and the Long-winged Harrier (6.7%). The Chimango Caracara was the most common recipient of reverse interactions (53.3% of the events), followed by the Southern Caracara (46.7%). It is important to note that all cases of reverse interactions performed by target species were in response to previous attacks of the other bird, as a mode of nest defense, or to avoid food piracy.

Our study represents a primary approach to one rarely explored aspect of raptor behavior in southern South America. Although the number of observations and the nature of data constrain the scope of our work, our findings contribute to a more complete understanding of the relationships among sympatric raptor and non-raptor birds.

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