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POSSIBLE SOCIAL FORAGING BEHAVIOR IN THE RED-BACKED HAWK (*BUTEO POLYOSOMA*)

Sergio Alvarado Orellana^{1,2} & Ricardo A. Figueroa Rojas^{2,3}

¹División de Bioestadística y Demografía, Escuela de Salud Pública, Facultad de Medicina, Universidad de Chile, Santiago, Chile.

²Estudios para la Conservación y Manejo de la Vida Silvestre Consultores, Blanco Encalada 350, Chillán, Chile.

Posible conducta de forrajeo social en el Aguilucho común (*Buteo polyosoma*).

Key words: Red-backed Hawk, *Buteo polyosoma*, White-throated Hawk, *Buteo albigula*, social foraging, cooperative searching, Chile.

Social foraging involves two or more individuals, cooperatively or non-cooperatively searching for or pursuing prey. While most birds of prey are reputedly solitary hunters, many cases and degrees of social foraging have been described (e.g., Knight & Knight 1983, Hector 1987, Bednarz 1988a, Silveira *et al.* 1997, Leonardi 1999). Ellis *et al.* (1993) defined four classes of social foraging behavior in raptors: non-cooperative hunting, cooperative searching, pseudo-cooperative hunting, and cooperative hunting. Non-cooperative hunting includes “group foraging” (independent convergence on highly vulnerable prey with little or no benefit from other individuals; prey are not shared; Bent 1938), “predaceous mimicry” (the raptor travels with nonraptors to disguise its presence and, thereby, approaches potential prey; Willis 1963), “distractive approach” (the raptor uses

activities of other birds or other moving things to camouflage its approach; Egler 1991), and “use of flushing agent” (raptor follows moving things and pursues flushed prey; Silveira *et al.* 1997). In cooperative searching, prey patches are shared and the time required to locate prey is reduced, but prey are not shared. This social foraging class includes “local enhancement” (cueing on hovering conspecifics; Knight & Knight 1983), “flock foraging” (flock formation to search for prey), and “information transfer” (learning of food sources by observing the behavior of flock mates at an aggregation site; Greene 1987). Pseudo-cooperative hunting consists of groups chaotically attacking large or elusive prey with enhanced success, but with no division of labor; prey are chaotically shared or not shared at all (Varland *et al.* 1991). Cooperative hunting, in contrast, is characterized by a clear division of labor which enhances success of prey capture; prey are shared according to some social order (e.g., dominance, hierarchy)

³Corresponding author e-mail: asio@surnet.cl & raptors@chile.com

and coordinating signals may be used (Bednarz 1988a, Ellis *et al.* 1993, Coulson & Coulson 1995). Cooperative hunting is executed by pairs, family groups, or sibling groups, and is generally related to cooperative breeding (Bednarz 1988a, 1988b). Because of the difficulty of obtaining quantitative data on free-ranging birds, the occurrence of social foraging in diurnal raptors could be underestimated (Ellis *et al.* 1993).

While the natural history of the Red-backed Hawk (*Buteo polyosoma*) has been well documented (Jiménez & Jaksic 1991, Jiménez 1995), social foraging has not been described for this species. We report the first evidence suggesting that Red-backed Hawks may forage socially. We also document unusual tolerance of two similar-sized species of hawks.

Our work was conducted during February 2002 and 2004 (austral summer) in the Los Huemules del Niblinto Nature Sanctuary and National Reserve (hereafter, Niblinto; 36°45'S, 71°29'W; 10,000 ha in size), located in the Andean mountain range of south-central Chile. Topography is rugged (800–2200 m in elevation, slopes up to 45°) and vegetation is composed primarily of mixed-deciduous *Nothofagus* spp. forests and shrublands characterized by a diversity of high Andean species. Climate is Mediterranean-temperate (see Figueroa *et al.* 2001 for details). Most observations were made from an elevated vantage point in the Niblinto valley (1000 m elevation) and were assisted by binoculars and spotting scopes when necessary. Species discrimination was based on silhouette and some diagnostic marks (e.g., black subterminal tail band). Age of birds was identified by plumage coloration.

Additional observations were made during March 2002 (austral summer) in the Fray Jorge National Park (hereafter, Fray Jorge; 30°40'S, 71°30'W, 235.4 ha in size) in north-central Chile. Vegetation is composed of several evergreen forest fragments (0.5–45 ha)

surrounded by a xeric scrub matrix. Climate is Mediterranean-arid. For a detailed description of habitats and climate, see Cornelius *et al.* (2000).

On 18 February 2002 (fledgling period), at 17:30 h, we observed five adult Red-backed Hawks flying over Colchón Mountain (2050 m maximal elevation) inside Niblinto. When first observed, all hawks were gliding parallel to one another (10–30 m in distance). Soon all were soaring 30–50 m apart for almost 9 min. On 21 February, at 13:00 h, we again observed five adult Red-backed Hawks soaring together above Colchón Mountain, apparently looking for prey. On several occasions, they went downward and explored shrubs, rocks, and rodents burrows flying 5–10 m above the ground. On 22 February, at 12:47 h, we observed three adult Red-backed Hawks soaring jointly above Colchón Mountain. At 12:51 h they separated. On the same day, at 14:29 h, four adult Red-backed Hawks were observed flying in close proximity (20–50 m apart), apparently searching for prey over the same area where they were observed during the previous days. Four minutes later, two hawks flew toward the west and two lit in a southern beech (*Nothofagus dombevi*) on the north-facing slope. The following day we climbed to the site where the hawks had been observed flying overhead (1200 m elevation). The area was a small terrace (1 km long and 0.5 km wide) covered by a mixed *Nothofagus* forest and shrublands. Numerous burrows of great rock rat (*Aconaemys fuscus*) were found on the ground. At 18:56 h, an adult Red-backed Hawk and a White-throated Hawk (*Buteo albicollis*) were observed soaring close together (20–50 m apart). On 19 February 2004, at 08:54 h, we observed three adult Red-backed Hawks soaring and hovering close together (10–20 m in distance) over the Niblinto valley between Baul and Colchón mountains. At 12:07 h, we observed two adult Red-backed Hawks soaring and an adult White-throated

Hawk hovering near them, almost 100 m above the small terrace on Colchón Mountain. No agonistic or aggressive behavior were initiated by either species during any of the observations.

On 6 March 2002 (fledgling period), at 14:00 h, we observed a non-aggressive interaction between a juvenile Red-backed Hawk and a juvenile Harris's Hawk (*Parabuteo unicinctus*) in Fray Jorge. The Red-backed Hawk vocalized as it flew vocalizing from a tree. Within 10–15 sec the Harris' Hawk joined it in flight. Both circled, descending into the forest, and then they disappeared. At 19:40 h, seven juveniles and an adult Red-backed Hawk and a juvenile Harris's Hawk were observed flying over a small forest patch. The juveniles of both species performed mock chase flights for almost 10 min but without evidence of aggression. Almost 15 min later, however, an adult Harris's Hawk chased a juvenile Red-backed Hawk, but not the juvenile Harris's Hawk. At 20:17 h, we observed seven Red-backed (all juveniles) and three Harris's hawks (one juvenile and two adults) moving closely in circling flights over an *Eucalyptus* spp. grove, but at 20:20 h an adult Harris's Hawk chased an adult Red-backed Hawk.

Following definitions of Ellis *et al.* (1993) definitions, we think that the Red-backed Hawk aggregations we observed are examples of social foraging, and, in particular represent either group hunting, local enhancement, flock foraging, or pseudo-cooperative hunting. The frequent use and possible sharing of the same food patch make us suppose that some type of cooperative searching could be occurring. Our scarce evidence supports local enhancement as the most probable social hunting mode. On occasions, after the first hawks arrived at the food patch on the Colchón mountain, other individuals joined them. This suggests that hawks were cueing on high flying birds to reduce the time required to locate prey. It is also of interest

that the Red-backed Hawk tolerates White-throated hawks while foraging because until now, only agonistic interspecific interactions have been reported between these species (Figueroa *et al.* 2001, Figueroa 2003). Hawk groups were sometimes composed of Red-backed and White-throated hawks, which are partially controphic. Both species prey on rodents, the first being a rodent-specialist predator (Schlatter *et al.* 1980, Jiménez 1995, Figueroa *et al.* 2003) and the second showing a more plastic diet (Trejo *et al.* 2003, Pavez *et al.* 2004). Previous to this report, we observed a White-throated Hawk capturing and consuming a rodent while Red-backed Hawks were nearby searching for prey (Figueroa *et al.* 2001). We observed no integrated movement of most or all members of aggregations from one area to another that might suggest flock foraging. It is also possible that hawks converged independently on the food patch in response to high concentrations of prey and good thermal updrafts (Jiménez & Jaksic 1991). Thus, the hawk aggregations could simply correspond to group foraging. In support of this idea, medium- and large-sized rodent prey (e.g., *Abrothrix* spp., *Aconaemys fuscus*, *Chelemys macronyx*) are concentrated in flat areas and moderately inclined slopes on the mountains where the observations occurred (Alvarado & Figueroa unpubl.).

The non aggressive interactions among juvenile Red-backed and juvenile Harris's hawks in Fray Jorge could best be interpreted as play behavior. The large group of juveniles associated with an adult Red-backed Hawk could suggest imitative social hunting (Varland & Loughin 1992) too. Aggression by adult Harris' Hawks toward Red-backed Hawks confirmed that older birds would defend their territory for resources.

The Red-backed Hawk has been described as a typically solitary hunter, forming monogamous pairs, and showing aggression toward conspecifics and other raptor species (Rey-

nolds 1935, Barros 1962, Wood 1975, Jimenez & Jaksic 1991). Thus, it is intriguing that groups of adult Red-backed Hawks socialized during the breeding season when we would expect them to occupy exclusive territories. Previously, large Red-backed Hawk aggregations (10 birds) were reported by Housse (1945) in central Chile, but he attributed these to local migratory movements. Our observations occurred in the latter part of the breeding season at a time when territorial behavior may be waning. The social behavior we observed may be an adaptation of a small fraction of the Red-backed Hawk population that confers some ecological advantage. Future studies on social foraging behavior of this species should further investigate the occurrence and frequency of this behavior as well as type(s) of social foraging employed.

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