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Cooperative Foraging in the Mountain Caracara in Peru

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ABSTRACT.—Cooperative foraging behavior is rarely observed in ground-walking birds. I report on observations of cooperative foraging behavior by Mountain Caracaras (*Phalco boenus megalopterus*) in the puna region of Peru in September of 1995. On several occasions, three individuals (two adults and one immature) were observed working together to turn over large rocks to obtain prey from beneath. These cooperative foraging events are notable in that, unlike cooperative foraging behavior observed in other ground-walking birds, only one individual obtained prey from a given cooperative effort. The presence of the immature individual may be indicative of delayed dispersal, a behavior not previously described for this poorly known species. Received 14 Dec. 1998, accepted 28 March 1999.

Cooperative foraging involves two or more individual organisms assisting one another in obtaining a food item. Among vertebrates, this behavior is well described in many social mammals (Macdonald 1983, Serfass 1995) and some fish (Dugatkin and Mesterton-Gibbons 1996) but is relatively uncommon in birds (Sullivan 1984). Among birds, cooperative hunting appears most frequently in seabirds (Parasitic Jaegers, *Stercorarius parasiticus*, Pruett-Jones 1980; Brown and American White pelicans, *Pelecanus occidentalis* and *P. erythrorhynchos*, J. Jones, unpub. data). Examples from land birds include the cooperative hunting behavior exhibited by Harris' Hawks (*Parabuteo unicinctus*; Mader 1979, Bednarz 1988), Golden Eagles (*Aquila chrysaetos*; Collopy 1983) and Crested Caracaras (*Caracara plancus*; Morrison 1996). Most of these instances of cooperative hunting involve highly mobile prey items; cooperative foraging for less mobile organisms is uncommon (Sullivan 1984). In this report, I

detail observations of cooperative foraging behavior in the Mountain Caracara (*Phalco boenus megalopterus*). This species is adept at ground foraging and in non-urban areas feeds on large arthropods, rodents, and birds (Brown and Amadon 1968). Breeding usually occurs between October and December with two, rarely three, eggs laid (Brown and Amadon 1968).

STUDY AREA

The observations were made in the Peruvian puna zone on the road between the towns of Quillabamba and Ollantaytambo, Department of Cuzco (13° 9' S, 72° 14' W; 3750 m elevation). This region is characterized by dry grasslands, dominated by genera such as *Calamagrostis* and *Festuca* with interspersed shrubs of the genera *Astragalus*, *Berberis*, and *Lupinus* (Parker et al. 1982). Mountain Caracaras are common in this region (Parker et al. 1982) and are often found near towns where they feed on refuse and carrion (White and Boyce 1987).

RESULTS

I observed cooperative rock-turning on four occasions from 1–6 September 1995, as I watched three individuals (two adults and one immature) foraging together on the puna grassland. The immature bird was easily distinguished by its plumage. On each occasion, one of the adults approached a large rock, walked around it, uttered a high-pitched *kieeer*, and then stood by the rock. Apparently responding to the vocalization, the other individuals joined the first at the rock and proceeded to work together to flip the rock from its resting place, with each bird using one of its talons. The bird that made the call participated in the the turning but also appeared to act as a “watcher” and was the individual responsible for prey capture. On one occasion, the item was captured by an adult which then gave it to the immature bird. No begging vocalizations were uttered by the younger bird nor did it adopt any unusual posture. Each lifting event took approximately 30 min from call

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to prey capture. This species, although a ground-foraging specialist, has weak legs (Brown and Amadon 1968). After examining the rocks (approximate dimensions $30 \times 20 \times 10$ cm), I do not believe that one individual could have turned over any of the rocks by itself.

At no time during the days of observation was the immature bird more than 100 m from one or the other of the adults, although the adults were often separated by distances up to 500 m. In a series of 12 one-hour watches ($n = 4$ for each individual), I determined that the two adults appeared to spend more time foraging than did the immature bird (adult = 68.6%, imm. = 52.3%) although the difference was not statistically significant ($\chi^2 = 3.334$, $df = 1$, $P = 0.067$).

Subsequent investigation revealed that worms or arthropods could be found under most (19 of 24) of the rocks in the vicinity; several of the rocks (5 of 24) also hid rodent runways. Examination of the surrounding grassland showed that prey items of a similar size but different taxa (e.g., grasshoppers rather than millipedes) were available without rock lifting.

DISCUSSION

Unlike most land bird species, Mountain Caracaras were not using cooperative foraging behavior to pursue and subdue large, highly mobile prey items. Rather, they required cooperation to obtain access to otherwise inaccessible prey items. While the turning over of small rocks was one of the main foraging behaviours exhibited by these individuals, the cooperative rock-turning events did not occur within the set watches and did not seem to represent a major foraging strategy for these individuals. The main difference between the cooperative behavior observed in Mountain Caracaras and that observed in other cooperatively foraging birds is that only one individual obtained food from a given foraging event; Harris' Hawks, for example, share large prey that are cooperatively caught (Bednarz 1988). This disparity in obtaining a food reward may even out over time (e.g., one of the four prey items was given to the immature bird) but there apparently is often no immediate reward for some of the individuals participating. That individuals are willing to help without a re-

ward is perhaps indicative of the length of time these birds remain together as a foraging unit; that is, an individual is willing to help today because its turn will come eventually (see Trivers 1971 for discussion of reciprocal altruism).

Congeners of the Mountain Caracara hatch their eggs in December and fledglings are usually independent by March (Brown and Amadon 1968). As my observations took place in September, the immature member of the trio was probably a chick from a previous breeding effort and its presence, therefore, may represent delayed dispersal. Delayed dispersal is fairly common in Neotropical raptors (Mader 1981). How common delayed dispersal is in Mountain Caracaras and how it may affect the incidence of cooperative foraging, is uncertain.

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Predation by Rufous Motmot on Black-and-Green Poison Dart Frog

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ABSTRACT.—I observed a Rufous Motmot (*Baryphthengus martii*) feeding a black-and-green poison dart frog (*Dendrobates auratus*) to another motmot in the Caribbean Slope lowland rainforest of northeastern Costa Rica. Neither individual appeared to suffer any ill effects from what was probably courtship feeding. Small vertebrates are typical prey for the larger species of motmots. Blue-crowned Motmots (*Momotus momota*) have been observed consuming several species of poison dart frogs raised in captivity but captive reared frogs either do not contain, or have reduced levels of, the toxins that native frogs produce. Relatively little is known about the effects of poison dart frog toxins on predators. Presumably, the digestive system of the Rufous Motmot is capable of neutralizing the potentially toxic effects of such prey. *Received 15 Sept. 1998, accepted 15 Feb. 1998.*

Poison dart frogs have long been known to possess toxic skin secretions, and, because of their bright coloration, are thought to be aposematic to visually hunting predators such as Rufous Motmots (*Baryphthengus martii*) which presumably have excellent color vision (Brodie and Tumbarello 1977). Smith (1975) demonstrated that hand-reared Torquoise-browed Motmots (*Eumomota superciliosa*) showed an innate avoidance of snake-shaped models with patterns simulating those of coral snakes. All other snake models were readily attacked implying that aposematic coloration is a deterrent to this species. Observations indicate that Blue-crowned Motmots (*Momotus momota*) at the National Aquarium consume several species of poison dart frogs including

the black-and-green poison dart frog (*Dendrobates auratus*) and phantasmal poison dart frog (*Dendrobates tricolor*). However, these frogs were raised in captivity and either do not produce or have relatively low levels of the characteristic skin toxins (Kricher 1997; C. Rowsom, pers. comm.).

At approximately 9:30 CST on 26 March 1995, an adult Rufous Motmot was observed in secondary lowland tropical forest from a hiking trail located at Estacion Biologica La Suerte, near Cariari, Limon Province, northeastern Costa Rica (10° 26' N, 83° 46' W). The bird landed 25 m from the trail on an exposed perch 3 m above the ground and was easily observed for approximately 4 min. After 4 min another individual landed on the same branch next to the first individual. The newly arrived motmot was carrying a black-and-green poison dart frog in its beak which it fed immediately to the first individual. It is not possible to distinguish between sexes in Rufous Motmots; however, this behavior was interpreted as a male who was feeding the female as a courtship gesture. Both individuals had diagnostic black breast marks and racket-tails indicative of adult birds, suggesting that this was probably not a fledgling being fed. The pair continued sitting on the branch for approximately 30 min after which they flew off together into the forest. Neither individual appeared to suffer any ill effects from either grasping or consuming the poison dart frog.

The typical diet of motmots varies somewhat in conjunction with body size. Smaller species prefer insects while larger species consume insects along with other invertebrates, small ver-

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