

that some substantial fraction of the males present in the transect area were not counted, the estimated population size would be increased proportionally.

We drove many miles of mountainous back roads throughout the census zone. We examined (with binoculars) openings to many canyons which appeared to contain vegetation similar to that found in canyons we surveyed. We believe our estimate that 40% of the region is structurally similar to the four canyons we sampled is conservative. Our survey sites were not chosen because we suspected Black-capped Vireos were present. We chose the four sites because we had obtained permission to enter them from local ranchers.

If this large population of Black-capped Vireos does exist in northern Mexico in a relatively small area, why is the population in Texas and Oklahoma so reduced? The birds are believed to be associated with a transitional type of habitat (Graber 1961) characterized as "scrub oak growth of irregular height and distribution with spaces between the small thickets and clumps" (Grzybowski et al. 1986). In contrast, we commonly found vireos in Mexico in dense thickets with few spaces between clumps of vegetation. These extensive scrub thickets may have resulted from the frequent uncontrolled wildfires which sweep through the canyons in this part of Mexico. This dense habitat type is uncommon in Texas and Oklahoma possibly owing to more intensive ranching and development in these states. We suggest that a denser structure with fewer open spaces may be better suited to breeding Black-capped Vireos and that this structure, along with less intensive ranching and fewer cowbirds accounts for a far larger population in northern Coahuila than in areas of similar size in Texas.

In speaking of this region of Mexico, A. R. Phillips (1974) says, "One may travel past range after range of mountains, and arroyo after arroyo, in which no ornithologist has ever set foot." The fate of the Black-

capped Vireo in the United States is inextricably linked to the Mexican population of this bird. A full understanding of the species' status requires much more work in Mexico.

LITERATURE CITED

- BARLOW, J. C. 1967. Nesting of the Black-capped Vireo in the Chisos Mountains, Texas. *Condor* 69: 605-608.
- COCHRAN, W. G. 1977. Sampling techniques. John Wiley and Sons, New York.
- GRABER, J. W. 1961. Distribution, habitat requirements, and life history of the Black-capped Vireo (*Vireo atricapilla*). *Ecol. Monogr.* 31:313-336.
- GRZYBOWSKI, J. A., R. B. CLAPP, AND J. T. MARSHALL, JR. 1986. History and current population status of the Black-capped Vireo in Oklahoma. *Am. Birds* 40:1151-1161.
- MARSHALL, J. T., R. B. CLAPP, AND J. A. GRZYBOWSKI. 1985. Status report: *Vireo atricapillus* Woodhouse, Black-capped Vireo. Office of Endangered Species, U.S. Fish and Wildlife Service, Albuquerque, NM.
- MILLER, A. H. 1955. The avifauna of the Sierra Del Carmen of Coahuila, Mexico. *Condor* 57:154-178.
- MULLER, C. H. 1947. Vegetation and climate of Coahuila, Mexico. *Madroño* 9:1-32.
- PHILLIPS, A. R. 1974. Summary of avian resources of the Chihuahuan Desert region, p. 617-620. *In* Transactions of the symposium of the biological resources of the Chihuahuan Desert region, United States and Mexico. Sul Ross State Univ., Alpine, TX.
- STEED, D. L. 1988. The Black-capped Vireo (*Vireo atricapillus*) in Travis County, Texas. Technical Brief, DLS Associates, Austin, TX.

The Condor 92:779-781
© The Cooper Ornithological Society 1990

AN OBSERVATION OF SOCIAL PLAY IN BEARDED VULTURES¹

DANIEL T. BLUMSTEIN

Animal Behavior Graduate Group, % Department of Zoology, University of California, Davis, CA 95616

Key words: *Social play; Bearded Vulture; Gypaetus barbatus; Pakistan; Khunjerab National Park.*

Play behavior has been defined as "all postnatal motor activity that appears to be purposeless, in which motor

patterns from other contexts may often be used in modified forms and altered temporal sequencing" (Bekoff and Byers 1981, p. 300). This note describes an observation that I interpreted to be social play (play directed towards another individual) in Bearded Vultures (*Gypaetus barbatus*: Accipitridae). Object play has been inferred in Bearded Vultures (Fagen 1981) when individuals drop and catch bones in the air (Olivier 1961, Huxley and Nicholson 1963) and when they drop stones from the air (Povolny 1966). I have found no reports

¹ Received 15 November 1989. Final acceptance 22 February 1990.

of social play in this species or other Old World vultures, and observations of play in birds appear to be underreported (Fagen 1981).

At 08:45 on 9 September 1989, I observed two immature Bearded Vultures flying together and calling about 50 m below me at Dhee Sar (36°81'N, 74°95'E) in Khunjerab National Park, Pakistan. Dhee Sar is a relatively flat high alpine meadow (elevation 4,100–4,300 m) surrounded by steep lateral moraines and punctuated with hilly terminal moraines. I observed the birds from a ridge above the meadow using 10 × 40 binoculars and a 15–45 power spotting scope. The birds were easily discriminated by feather-loss patterns. For the next 12 min, I watched the two birds take turns chasing each other. One would glide up to within a meter of the tail of the other, and then the roles were reversed. Sometimes they dived, one still chasing the other. This activity was accompanied by little flapping. On no occasion did I observe physical contact, nor did I observe any objects carried in their talons. My observation of the two birds ended when they flew out of sight behind a mountain.

A high-pitched prolonged whistle accompanied this behavior. The one note whistle was repeated while the two birds were close to each other. I recorded this vocalization, but background wind noise prevented me from producing a clean sonogram. Ali and Ripley (1987, p. 79) reported that Bearded Vultures utter a "sharp guttural koolik, koolik" during aerial courtship displays, but they otherwise rarely vocalize. The voice of a Bearded Vulture has also been described as a "whistle" or "mew" (Dement'ev and Gladkov 1966, Flint et al. 1984) or a "guttural hiss" (Fleming et al. 1984).

My observation has at least three mutually exclusive interpretations. First, the Bearded Vultures could have been courting. The breeding season in Asia for Bearded Vultures is between November and March (Lowther 1949, Ali and Ripley 1987). Ali and Ripley (1987) reported aerobatic displays around the beginning of the breeding season. Dement'ev and Gladkov (1966) reported nuptial flights at the end of January or the beginning of February which included aerial displays. I reject the courtship hypothesis on three counts: the birds were both in immature plumage, early September seems to be too early for courtship displays based on the published records, and the vocalization was not the "koolik, koolik" described by Ali and Ripley (1987) to accompany courtship displays.

Second, the birds could have been fighting or threatening each other. I reject this hypothesis on two counts: there was never any contact between the birds, and the birds alternated roles during the 12 min I observed the interaction.

Finally, the birds could have been playing. I have not been able to reject this hypothesis, and three of my observations support this as the likely explanation of the observed behavior. First, the two birds were juveniles; play is most likely to be seen in juvenile animals (Fagen 1981). Second, the behavior appeared reciprocal in that one bird was not always chasing the other—roles changed frequently. An important characteristic of social play behavior is changes in chase-flee relationships (Bekoff 1984). Third, social play is often accompanied by play signals that may be important, particularly during potentially dangerous play,

by reassuring participants that they are indeed playing (Bekoff 1978). I suggest the repeated high-pitched vocalization heard was a play signal.

Social play is expected in birds like Bearded Vultures for several reasons (Ortega and Bekoff 1987). They mature slowly, remaining in subadult plumage for 5 years (Dement'ev and Gladkov 1966). Courtship "practice" might improve skills required later in life. Practice chasing conspecifics under low-risk situations might be beneficial for later chases of heterospecifics. For example, Fleming et al. (1984) described Bearded Vultures chasing Himalayan Griffon Vultures (*Gyps himalayensis*) in the air. Also, since Bearded Vultures may live in large groups (Brown and Amadon 1968), play might be important for social cohesion (Fagen 1981).

I thank M. Bekoff, J. Marzluff, W. Shriner, T. Roberts, and an anonymous reviewer for helpful comments on a previous version of this manuscript. I also thank the Pakistan National Council for Conservation of Wildlife and the director of Khunjerab National Park for permission to work in Pakistan. Fieldwork was generously supported by grants from The Explorers Club, and a University of California, Davis Graduate Research Award and Jastro-Shields Graduate Research Scholarship.

LITERATURE CITED

- ALI, S., AND S. D. RIPLEY. 1987. Compact handbook of the birds of India and Pakistan together with those of Bangladesh, Nepal, Bhutan and Sri Lanka. 2nd ed. Oxford Univ. Press, Delhi.
- BEKOFF, M. 1978. Social play: structure, function, and the evolution of a cooperative social behavior, p. 367–383. In G. M. Burghardt and M. Bekoff [eds.], *The development of behavior: comparative and evolutionary aspects*. Garland STPM Press, New York.
- BEKOFF, M. 1984. Social play behavior. *Bioscience* 34:228–233.
- BEKOFF, M., AND J. A. BYERS. 1981. A critical reanalysis of the ontogeny and phylogeny of mammalian social and locomotor play: an ethological hornet's nest, p. 296–337. In K. Immelmann, G. W. Barlow, L. Petrinovich, and M. Mains [eds.], *Behavioral development: the Bielefeld interdisciplinary conference*. Cambridge Univ. Press, Cambridge.
- BROWN, L. H., AND D. AMADON. 1968. *Eagles, hawks, and falcons of the world*. McGraw-Hill, New York.
- DEMENT'EV, G. P., AND N. A. GLADKOV. 1966. *Birds of the Soviet Union*. Vol. 1. Israel Program for Scientific Translation, Jerusalem.
- FAGEN, R. 1981. *Animal play behavior*. Oxford Univ. Press, New York.
- FLEMING, R. L., SR., R. L. FLEMING, JR., AND L. S. BANGDEL. 1984. *Birds of Nepal with reference to Kashmir and Sikkim*. 3rd ed. Nature Himalayas, Kathmandu.
- FLINT, V. E., R. L. BOEHME, Y. V. KOSTIN, AND A. A. KUZNETSOV. 1984. *A field guide to the birds of the USSR including Eastern Europe and Central Asia*. Princeton Univ. Press, Princeton, NJ.
- HUXLEY, J., AND E. M. NICHOLSON. 1963. *Lammer-*

- geier *Gypaetus barbatus* breaking bones. *Ibis* 105: 106–107.
- LOWTHER, E.H.N. 1949. The Lämmergeier (*Gypaetus barbatus*) Linnaeus. *J. Bombay Nat. Hist. Soc.* 46: 501–508.
- OLIVIER, G. 1961. Quebranta—huesos. *Alanda* 29: 226–227.
- ORTEGA, J. C., AND M. BEKOFF. 1987. Avian play: comparative evolutionary and developmental trends. *Auk* 104:338–341.
- POVOLNY, D. 1966. Über ein Spiel des Bartgeiers (*Gypaetus barbatus*). *J. Ornithol.* 107:352–353.

The Condor 92:781–783
© The Cooper Ornithological Society 1990

A FORAGING ASSOCIATION BETWEEN TWO KITE SPECIES
(*ICTINEA PLUMBEA* AND *LEPTODON CAYANENSIS*) AND
BUFFY-HEADED MARMOSETS (*CALLITHRIX FLAVICEPS*)
IN SOUTHEASTERN BRAZIL

STEPHEN F. FERRARI

*Department of Anthropology, University College, London and Departamento de Zoologia,
Museu Paraense Emilio Goeldi, Caixa Postal 399, 66.040 Belém-PA, Brazil*

Key words: *Ictinea plumbea*; *Leptodon cayanensis*; *Callithrix flaviceps*; primates; foraging association.

Many insectivorous birds, notably those of the Formicariidae (Willis and Oniki 1978), are known to systematically exploit the disturbance of prey caused by the foraging activities of other animals. Recent studies (Fontaine 1980, Terborgh 1983, Boinski and Timm 1985, Boinski and Scott 1988, Siegel et al. 1989) have reported this type of foraging association between a variety of Neotropical bird species and platyrrhine monkeys of the genera *Saguinus* (Callitrichidae), and *Cebus* and *Saimiri* (Cebidae).

The present report describes a foraging association involving both Plumbeous (*Ictinea plumbea*) and Grey-headed (*Leptodon cayanensis*) kites with groups of buffy-headed marmosets (*Callithrix flaviceps*). The association is unusual in being restricted to both a specific type of prey (cicadas) and a particular time of year.

STUDY SITE AND OBSERVATIONS

The association reported here was recorded during studies of the ecology of the buffy-headed marmoset (adult body weight approximately 0.4 kg), carried out in a privately owned forest reserve on the Fazenda Montes Claros in Minas Gerais, southeastern Brazil (19°50'S, 41°50'W). The study area was composed of hilly secondary and disturbed forest habitats bordered on three sides by open fields and on the fourth by the less disturbed forest of the main body of the reserve. Rainfall at the site averages 1,145 mm annually, with a clearly defined dry season normally spanning the period between April and September. For a more detailed description of both the study site and methodology, see Ferrari (1988).

In addition to the main study, during which the behavior of an habituated marmoset study group (containing between 11 and 15 members) was recorded in detail, less systematic observations of this and other groups were begun in December 1984 and have continued sporadically up to the present day. The main study involved the collection of scan sample records of the behavior of the study group during at least 10 days each month between August 1985 and August 1986 (Ferrari 1988). All observed interactions with other animal species were recorded opportunistically.

RESULTS

Callithrix flaviceps was observed interacting with a range of bird species as both potential prey and predator. The marmosets displayed an extensive repertoire of anti-predator behaviors, a majority of which was related to the avoidance of raptors, whose characteristic flight profile provoked an intense reaction (Ferrari and Lopes Ferrari, in press). Medium-sized birds of prey, including *Micrastur ruficollis* (Izawa 1978), *M. semitorquatus* (Alonso and Langguth 1989), *Spizaetus ornatus* (Dawson 1976, Goldizen 1987), and *S. tyrannus* (Dawson 1976), appear to be the principal predators of callitrichids. *Callithrix flaviceps*, in turn, was observed feeding on eggs of the Rufous-collared Sparrow (*Zonotrichia capensis*) on two occasions and on an unidentified fledgling on a third occasion.

The foraging associations with both *I. plumbea* and *L. cayanensis* represent a third, highly specific type of interaction between the marmosets and birds. As observed in other bird/monkey associations, the kites exploited prey flushed by the marmosets during their foraging activities. Unlike other associations, however, this behavior was both highly seasonal and involved the capture of a single type of prey, large-bodied cicadas (Homoptera: Cicadidae).

Mature cicadas were particularly abundant in the study area during the early wet season month of Oc-

¹ Received 15 November 1989. Final acceptance 26 April 1990.