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COMMENTS ON FEEDING HABITS AND VULTURE-MIMICRY IN THE ZONE-TAILED HAWK

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That the Zone-tailed Hawk (*Buteo albonotatus*) is an aggressive mimic of the Turkey Vulture (*Cathartes aura*) has been convincingly suggested by Willis (Condor 65:313–317, 1963). Essential to this thesis is the conditioning of vertebrate prey to the benign presence of the ubiquitous vulture, thus permitting approach of the predatory hawk to within striking distance.

Mueller (Condor 74:221, 1972) believed aerodynamic considerations, not mimicry, to be responsible for the Zone-tail's dihedral and manner of flight. He noted that raptors which habitually fly near the ground share this design, not only the Turkey Vulture and Zone-tailed Hawk, but also the harriers (*Circus* spp.). Unfortunately, we lack information on the relative frequency and importance of "high" vs. "low" hunting by *Buteo albonotatus*.

Willis (*op. cit.*; Condor 67:104–105) twice witnessed Colombian Zone-tails pursuing prey, but he found little information on the hunting of North American birds. The few references he cited leave much to be desired, one of them possibly not referring to *Buteo albonotatus* at all. Despite several attempts over the past six years I have not succeeded in following a Zone-tail from its breeding site to a feeding area. The following account is of a chance encounter with an individual actively seeking prey on 3 July 1969.

Driving northwest of Silver City, New Mexico, my attention was drawn to a flying vulture-like bird. As the time was 08:55 (Mountain Daylight Time), 30 to 40 minutes before Turkey Vultures take wing locally, I stopped and confirmed my suspicion that the bird was a Zone-tailed Hawk. It flew slowly, 15 to 20 m above ground, near some low hills flanking a dry valley several km long and less than 1 km across. Occasionally the bird descended to about 10 m, tilting irregularly as it progressed along the hillsides precisely as do vultures in their regular efforts to detect carrion in this valley.

For 40 minutes the hawk cruised back and forth parallel to the elevated ridges, occasionally returning to certain favored areas over which it flew repeatedly. It concentrated on the bases of the hills, but neglected neither their summits nor the yucca- and mesquite-studded valley floor. Once, over the latter, from a height of about 25 m, the hawk half-folded its wings and plunged almost vertically toward a spotted ground squirrel (*Spermophilus spilosomus*). It dropped almost to the ground but swooped upward as the rodent escaped under a mesquite. Following this attempt, the hawk slowly passed over the valley, hunting continuously. As it approached the juniper and oak scrub on the opposite side, it was attacked by a male American Kestrel (*Falco sparverius*) which swooped repeatedly, not striking but coming very close and protesting vocally. The Zone-tail promptly accelerated and left the vicinity, flying just above ground for a short distance, then ascending to its usual hunting altitude of about 25 m. The falcon returned to its perch after pursuing the hawk for a minute or so. On the preceding day I had seen two fledgling kestrels here with their parents. Their presence possibly triggered the falcon's aggressive reaction.

During the entire hunting episode the Zone-tail covered a linear distance of at least 1 km. At 09:40 several Turkey Vultures appeared along the hills. By then the hawk had climbed to an elevation of perhaps 200 m over the valley floor, still maintaining its vulturine appearance, gliding and occasionally flapping. At no time did it flatten its wings. Suddenly, it plummeted earthward toward something invisible to me. Missing again, it came out of its impressive dive barely above ground—this time pursued vigorously and vociferously by two Western Kingbirds (*Tyrannus verticalis*) which launched from some tall yuccas, one of which held their nest. After the flycatchers returned to their territory, the hawk remained in view for another ten minutes before disappearing over the ridge. It did not join the vultures which were taking advantage of rising warm air currents near the hills.

Birds and mammals witnessing other species' aggressive reactions toward a Zone-tailed Hawk probably would be alerted and ready for escape. Certainly the attention-attracting responses of the kingbirds and kestrel cited above should have aroused most potential avian and mammalian prey in the vicinity. Such reactions to Zone-tails could be construed as an argument against the efficacy of any alleged mimicry. On the other hand, these observations do not necessarily indicate recognition of the Zone-tailed Hawk as a predator. Kingbirds com-

monly chase from their territories most kinds of large birds, not only acknowledged predators such as ravens (*Corvus* spp.) and raptors, but also inoffensive herons. Both Western and Cassin's kingbirds (*T. vociferans*) pursue Turkey Vultures at times. The kestrel's reaction may be more significant, for I often have seen Turkey Vultures flying near kestrels in their nest-trees without eliciting any noticeable reaction. In the same parts of southwestern New Mexico I have observed these falcons dive repeatedly upon circling Red-tailed and Gray hawks (*Buteo jamaicensis* and *B. nitidus*). I have also watched a kestrel fiercely attack a flying Black Hawk (*Buteogallus anthracinus*), striking and actually alighting on the latter's back, apparently biting forcefully while being transported a considerable distance by the hawk whose aerial agility nevertheless failed to dislodge the falcon.

One morning I twice saw a low-flying Turkey Vulture startle a mixed flock of migrant birds resting beside a desert rain-pool near Lordsburg, New Mexico. The vulture's initial appearance promptly scattered the assemblage; ducks scrambled into the water, Avocets (*Recurvirostra americana*) flew to the opposite shore, dowitchers (*Limnodromus* sp.) became airborne as a unit and circled several times before realighting. Ten minutes later a vulture appeared as before, producing a similar but weaker reaction: the avocets not taking wing and the ducks and dowitchers moving much less than formerly though remaining alert.

Nor do small mammals altogether ignore Turkey Vultures. Near Tucson, Arizona, where *Spermophilus harrisi* and *S. tereticaudus* were frequent visitors in front of my photographic blinds, vultures often passed overhead. As I would notice their shadows the squirrels invariably became alterted. They would either assume an upright "picket-pin" position or remain crouched and motionless. Momentary "freezing" also was their usual response to the occasional Red-tailed Hawk or Common Raven (*Corvus corax*) that appeared overhead. But would such attentiveness—merely being alerted to a vulture's presence—detract from the mimicry value of a Zone-tailed Hawk that might appear at rare intervals? In hunting, this uncommon predator often (and I suspect typically) ranges far from its nest. Zone-tails forage over vast areas and a given population of prey animals probably would not encounter them frequently. The ground squirrels I observed invariably remained still until any large overhead bird passed by; but I did not time them, and a split-second's difference in a rodent's reaction time following recognition of a vulture or vulture-mimic as opposed to an obvious hawk, might be significant. To be effective mimicry need not work all of the time. Although I am inclined to accept Mueller's premise, vulture mimicking by the Zone-tailed Hawk remains an intriguing concept and is deserving of consideration by field observers.

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Accepted for publication 2 September 1975.

REMAINS OF PLEISTOCENE BIRDS FROM ISLA DE GUADALUPE, MEXICO

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In the course of extensive field work on Isla de Guadalupe, Hubbs has discovered, and has extensively sampled, a fossil-rich formation that extends intermittently along "two thirds of the eastern shoreline (for about 12 miles) and up the west coast for about 2 miles" .....and "occurs consistently from one to five meters above present sea level" (Hubbs, *in* Proc. Symp. Calif. Islands, Santa Barbara Botanic Garden, 1967). The formation is interpreted as of Sangamon Interglacial age because two samples have been isotope dated at about 110,000 and 130,000 yr. BP, and because of the large representation of tropical marine invertebrates: a tropical coral of the genus *Pocillopora* comprises the bulk of the fossils and there are several tropical gastropods that are likewise now confined to the warm waters from near the mouth of the Gulf of California to northern Peru. These tropical elements are intimately admixed with San Diegan (warm-temperate) faunal elements. These fossils occur in a calcareous matrix that has more or less firmly cemented the fine to very coarse debris that had fallen down the precipitous cliffs, in large part after the material had been reworked by the moderate wave action of this coastline (fig. 1).

In April 1970, we, assisted by Robert L. Wisner and Ronald R. McConnaughey, of Scripps Institution, discovered four fragments of avian fossils in a small area of the formation about 30 m from the southeastern tip of what we call "Red Cinder Cone Point," where the eastern coastline turns abruptly southwestward for a very short distance, at 29°00′50″N., 117°13′10″W. (as measured on H. O. Chart 1688, Survey of 1951; new number N. O. 21661), 8.0 miles northerly from the southeastern tip of the island. The bones were taken from well-cemented material filling some crevices in the rock on a slight bench a little above present high-tide line. Although numerous other exposures of the formation have been worked, here and elsewhere on the island, no additional fossil bird bones have been found. The specimens being reported are the only fossil vertebrates known from Isla Guadalupe, which, being an oceanic island rising from the sea floor, was almost surely never prehistorically reached by amphibians, or by terrestrial reptiles or mammals.

Considering the conditions of deposition it seems remarkable that even these fragmentary bird bones have survived, along with invertebrate fossils typical of the formation. Only two of the four avian fossils can be identified. They represent:

Puffinus cf. *puffinus opisthomelas*.—Distal 22 mm of a right humerus (San Diego Nat. Hist. Mus. Paleo. colls. no. 04294). The fragment is worn on the articular surface and is split longitudinally. The shaft is flattened and enough remains to indicate that it represents a small procellariiform bird the size of *Puffinus puffinus opisthomelas*.

Endomychura cf. *E. hypoleuca*.—SDNHM no.