IS THE ZONE-TAILED HAWK A MIMIC OF THE TURKEY VULTURE?

By Edwin O. Willis

We usually think of a mimic as an animal protected from predators by its resemblance to a distasteful animal, the model. The mimic itself may be distasteful (Müllerian mimicry) or palatable (Batesian mimicry). However, E. G. Peckham (*fide* Poulton, 1890) has pointed out that some animals may be aggressive mimics, which use resemblance to another animal to get close to prey, rather than protective (Batesian or Müllerian) mimics. The Zone-tailed Hawk (*Buteo albonotatus*) may be an aggressive mimic of the Turkey Vulture (*Cathartes aura*). As many ornithologists have noted, the two species are very similar in appearance and behavior. I suspect that the prey of the uncommon hawk become so accustomed to the repeated passing of the common and inoffensive vulture that they ignore the hawk.

Cathartes aura is a familiar sight from the northern United States to Argentina, but *Buteo albonotatus* is generally uncommon over its range from the southwestern United States to Paraguay. Two requirements for this form of mimicry are thus fulfilled: the mimic is less common than the model and its range lies within the range of the model. A third requirement for successful mimicry, that the mimic should associate with the model, has been met for each of the dozen or so Zone-tailed Hawks I have seen. I have watched individuals soar among vultures for long periods along the shores of Barro Colorado Island (Canal Zone, Panamá) and along the cliffs north of Arroyo Mesteño in the Sierra del Nido of Chihuahua, México. I have observed hawks for shorter periods among vultures above Madera Canyon and Patagonia in southeastern Arizona, near Quarry Heights (Balboa, Canal Zone) and the airport at David (Chiriquí) in Panamá, and near Puerto Belgica (Antioquia) in Colombia.

The Zone-tailed Hawk is the only North American hawk which is essentially black like a Turkey Vulture in all plumages (Friedmann, 1950). Although several species show melanistic phases, from which a mimic of vultures could evolve, all species but *B. albonotatus* show either light phases among the adults or streaked underparts when young. For aggressive mimicry of vultures to succeed, a young hawk must either forage differently from its parents or resemble a vulture. In my experience young *B. albonotatus* both forage like adults and resemble vultures. The white spots at the bases of the ventral feathers are usually concealed by the black tips of the feathers and seldom show when the young hawks soar overhead.

Gray remiges contrast conspicuously with black coverts under the wings of both *C. aura* and *B. albonotatus*. As is often true in mimicry, the same end is achieved by different means. The remiges of the hawk are narrowly barred with dark and pale gray. At a distance the bars cannot be clearly resolved, so the remiges seem medium gray like those of *C. aura*. Several other melanistic hawks approach this pattern, so it is possible that the ancestors of Zone-tailed Hawks were at least partly preadapted for mimicry of vultures.

Young *B. albonotatus* have narrow dusky and gray bands under the rectrices as well as under the remiges, so that at a distance their tails seem gray like the tails of *C. aura*. Adult hawks have white bands under their tails. However, the proximal bands are concealed in flight by the long black feathers of the legs, and the distal band is not often visible when the tail is closed as it normally is during foraging. Possibly the white bands are retained for sexual or other intraspecific displays even if prey may occasionally notice the outer band.

Zone-tailed Hawks resemble Turkey Vultures in shape as well as in color. Most

members of the genus *Buteo* have broad wings, but *B. albonotatus* has long and narrow wings as does the Turkey Vulture. Peterson (1961) illustrates the difference between *B. albonotatus* and other buteonine hawks and the similarity of *B. albonotatus* and *C. aura* very well. The tail of the Zone-tailed Hawk is moderately long, like the tail of *C. aura,* even though the tails of many buteonine hawks are short.

However, the Turkey Vulture and the Zone-tailed Hawk differ markedly in the shape and color of the head. In *C. aura* the head is bare and red and is much smaller than the ruff of feathers on the neck. In *B. albonotatus* the head is feathered and hence larger than that of *C. aura* for the size of the bird. Still, I almost never could tell the hawk from a vulture at a distance by differences in the shape of the head. During foraging the Zone-tailed Hawk holds its head back so close to the wings that the head forms a minor fraction of the silhouette. I have received suggestions that perhaps the head of the hawk corresponds to the ruff of the vulture, or that the white forehead of the hawk may break the outline of the head so that the beak or lower part of the head of the hawk corresponds to the silhouetted head of the vulture, but I did not notice such effects in the field.

To be sure, the hawk is smaller than the vulture. However, it is difficult to judge the size of objects against the sky, as *C. aura* and *B. albonotatus* are usually seen. Indeed, smaller size may allow the hawk to soar closer to prey if it judges the distance of familiar objects by apparent size as we sometimes do.

If the hawk did not resemble the vulture in behavior, these resemblances in color and shape would be of little value. Unlike most hawks of the genus *Buteo, B. albonotatus* does not ordinarily sit on a perch waiting for prey nor does it hover over open country in the manner of *B. lagopus* or *B. regalis*. Instead, the Zone-tailed Hawk soars rapidly along at 50 to 100 feet above the ground with a tilting, irregular flight in the fashion of a Turkey Vulture quartering the wind currents. In soaring the hawk has adopted the style of the vulture, for both soar with wings up at a dihedral. Although there are a number of hawks which soar briefly with wings at a dihedral (for instance the harriers, *Circus*), nearly all hawks and vultures soar with wings flat when they soar for long periods. The only exceptions I know are the Zone-tailed Hawk, the Turkey Vulture, and the Yellow-headed Vulture (*Cathartes burrovianus*). Probably the similarity in the shape of the wings of these three is related to their similar manner of soaring. I suspect that *B. albonotatus* is less efficient in this kind of soaring than are the species of *Cathartes*. The hawk generally hunts where cliffs or edges of the forest create strong updrafts, whereas vultures soar almost anywhere. Possibly both the need for topographical and other features which create strong and dependable updrafts and the need for open country in this style of hunting limit the Zone-tailed Hawk to only a small fraction of the habitats the Turkey Vulture occupies. Whether or not the hawk is efficient in soaring, to my eyes the similarity in style of soaring is even more important in making the hawk resemble the Turkey Vulture than are the black color, the narrow-winged shape, and the two-toned patterns of the lower surfaces of the wings in both species.

The only time I have seen a Zone-tailed Hawk try for prey was a striking example of this style of foraging. On June 10, 1962, I was watching Purple Gallinules (*Porphyrula martinica*) stalking through the scattered rushes of a recently flooded marsh by the Cauca River near Puerto Belgica, Colombia, when suddenly out of the midst of the vultures soaring 75 feet above the marsh along the low escarpment nearby a bird plummeted to the rushes as if shot. Immediately gallinules for hundreds of feet around cackled and fluttered to cover, and a pair of swallows (*Iridoprocne albiventer*) gave

chase to the "vulture," which I now saw was a Zone-tailed Hawk. The hawk flapped heavily as it rose from the marsh, while gallinules clucked behind cover. Finally the hawk set its wings to a dihedral and soared off over the escarpment. The gallinules emerged and resumed feeding, even though the hawk soared past twice more among the vultures only 75 feet overhead. The swallows had deserted the hawk before it began soaring, and none of the swallows circling over the marsh chased the hawk again during the twenty minutes I watched it soar back and forth. This incident illustrates that resemblance to a vulture may keep birds from mobbing the hawk or giving the alarm.

May (1935:51) has noted Zone-tailed Hawks foraging in similar ways. He comments that they often frequent canyons "where they circle about scouring the cliffs, or, mounting high in the air, dive screaming almost to the water at the bottom." However, he also reports that they occasionally hover over the water like Ospreys. Bailey (1921) records an instance when cotton rats driven out of a marsh by a fire were attacked by "hundreds" of Zone-tailed Hawks. Most animals vary their methods of foraging, and I would expect that *B. albonotatus* might occasionally take prey in a manner which would not involve mimicry. The question is, does the hawk usually soar along like a vulture and dive on prey thus approached? We need further observations by all who encounter the Zone-tailed Hawk.

We should also determine whether the usual prey of *B. albonotatus* actually have the visual acuity and the behavioral characteristics which could allow a hawk to evolve a resemblance to a vulture. The Zone-tailed Hawk has a varied diet; according to Bent (1937) it feeds mainly on lizards, frogs, and small fishes but also is known to take small birds and mammals. Swarth (1920) found that one had captured a Gambel Quail (*Lophortyx gambelii*) and another had taken a Gila chipmunk (*Eutamias dorsalis*). He and others have been rather surprised that such a "sluggish" hawk could capture such wary prey; but if the hawk is a mimic of vultures, it could easily surprise such prey. Certainly birds have both the visual acuity and the behavioral characteristics which could help the Zone-tailed Hawk become an aggressive mimic. Schleidt (1961), in tests of Tinbergen's reports that various birds react to a "hawk" silhouette but not when it is towed in reverse to form a "goose" silhouette, clearly shows that turkey hens react less strongly to hawk silhouettes which have been presented to them repeatedly. It is probable that squirrels and chipmunks, the most likely mammalian prey of *B. albonotatus*, have good visual acuity and can habituate to such a repeatedly presented stimulus as a soaring *C. aura*. It is likely that the Zone-tailed Hawk preys mainly on lizards, a third group of animals with very good visual acuity (Duke-Elder, 1958). Thorpe (1956) considers that ability to habituate, or to lose responses which are not reinforced, is probably nearly universal among animals. He argues that, even if an animal with many possible predators should react negatively to any sudden or strange stimulus, inability to learn to stop reacting to repeatedly presented harmless stimuli would "make life impossible." However, the tendency of squirrels and lizards of open country to habituate to the shape or pattern of the Turkey Vulture should be tested. We also know little about the ability of toads or frogs or fishes to habituate to repeatedly presented innocuous stimuli. Of course, it is not necessary that every potential prey of the hawk be able to see and habituate to the "vulture image"; if only some of the prey do so, a hawk which mimics vultures would fare better than one which does not.

Are there any other examples of this kind of mimicry? Brower, Brower, and Westcott (1960) discuss aggressive mimicry as it applies to the robberflies (*Mallophora bomboides*) which are mimics of and predators on bumblebees (*Bombus americanorum*). However, there is some doubt in this and similar cases among insects and spiders

whether the mimicry is aggressive or protective or both. Does the robberfly avoid predation because it is like the bumblebee or does the fly use the resemblance as a "wolf in sheep's clothing"? It has been suggested that the bird-eating hawk *Accipiter bicolor pileatus* is an aggressive mimic of the inoffensive (?) kite *Harpagus diodon*, but Amadon (1961) finds the evidence inconclusive. Only in the case of the Zone-tailed Hawk is it likely that any mimicry is primarily aggressive and not protective.

One wonders if other hawks might mimic vultures. The Common Black Hawk (*Buteogallus anthracinus*) resembles the Black Vulture (*Coragyps atratus*) very closely in flight. However, *B. anthracinus* usually perches when waiting for prey, and in such a pose does not resemble the vulture. Moreover, immature *B. anthracinus* are streaked underneath and look very different from Black Vultures. Possibly there may be mimics of vultures in the Old World.

The South American fish *Monocirrhus polyacanthus* resembles a dead leaf floating with the current and thus glides close to and snaps up smaller fish (Cott, 1957). This case bridges the gap between aggressive mimicry and ordinary resemblance to the background or use of part of the body as a lure among predators. The fundamental unity of mimicry and other types of concealing coloration is as true for predators as it is for prey.

SUMMARY

The uncommon Zone-tailed Hawk (*Buteo albonotatus*) differs from related hawks and closely resembles the common Turkey Vulture (*Cathartes aura*) in color, shape, and manner of soaring. Several observations indicate that a foraging *B. albonotatus* ordinarily soars with vultures. Once a hawk was seen to dive at prey from such a group of vultures. It is suggested that *B. albonotatus* soars close to and dives on animals which have become accustomed or habituated to the repeated passing of the inoffensive vulture. It may also be that animals would sound the alarm or mob the hawk if it did not resemble a vulture. To determine whether *B. albonotatus* is actually an aggressive mimic of *C. aura* it is necessary to observe further the foraging behavior of the hawk and to test lizards and other possible prey for tendency to habituate to the vulture.

LITERATURE CITED

Amadon, D.
1961. Relationships of the falconiform genus *Harpagus*. Condor, 63:178–179.

Bailey, F. M.
1921. Handbook of birds of the western United States (Houghton Mifflin Co., Boston).

Bent, A. C.
1937. Life histories of North American birds of prey (Part 1). U. S. Nat. Mus. Bull. 167.

Brower, L. P., Brower, J. Van Z., and Westcott, P. W.
1960. Experimental studies of mimicry, 5. Amer. Nat., 94:343–355.

Cott, H. B.
1957. Adaptive coloration in animals (Methuen and Co., Ltd., London).

Duke-Elder, Sir Stewart
1958. System of ophthalmology, Vol. I (C. V. Mosby Co., St. Louis).

Friedmann, H.
1950. The birds of North and Middle America. U. S. Nat. Mus. Bull. 50, pt. 11.

May, J. R.
1935. The hawks of North America (National Audubon Society, New York).

Peterson, R. T.
1961. A field guide to western birds (Houghton Mifflin Co., Boston).

Poulton, E. B.
1890. The colours of animals. The International Scientific Series, Vol. 67 (D. Appleton and Co., New York).

Schleidt, W. M.
1961. Reaktionen von Truthühnern auf fliegende Raubvögel und Versuche zur Analyse ihrer AAM's. Zeits. f. Tierpsych., 18:534–560.

Swarth, H. S.
1920. Birds of the Papago Saguaro National Monument (Government Printing Office, Washington), 1–63.

Thorpe, W. H.
1956. Learning and instinct in animals (Harvard Univ. Press, Cambridge, Mass.).

Museum of Vertebrate Zoology, Berkeley, California, November 14, 1962.