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## AN EVALUATION OF PATAGIAL MARKERS FOR CATHARTID VULTURES

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Since Henckel's (1976) report that leg-bands may cause foot and leg lesions when used on cathartid vultures, the U.S. Fish and Wildlife Service has revoked leg-banding permits for these species; yet no alternate means of marking vultures have been recommended. This paper describes the use of plastic-rivet, cattle ear-tags as permanent wing markers for vultures. We also present information on the relative merits of various wing markers and the effects these markers have on the vultures.

Wing markers have been used on a variety of species with good results (e.g. Hewitt and Austin-Smith 1966, Southern 1971, Kochert 1972). Generally, these markers have been made of vinyl strips that encircle the wing between secondaries and scapulars. Patagial tags that actually pierce the patagium have been used successfully (Anderson 1963, Knowlton et al. 1964). Anderson (1963) secured markers on the wings of several species of shorebirds by piercing the patagium with a nickel-chrome pin and found the plastic tabs attached to the pin visible and no observable handicap to the birds. Bartelt and Rusch (1980) marked Coots (*Fulica americana*) with tags held in place by a nylon "I" that pierced the patagium. They found good retention and no appreciable increase in mortality. John Ogden (pers. comm.), in a study of Wood Stork (*Mycteria americana*) movements, used cattle ear-tags with colored vinyl patches as markers. The tags were put on over 1,000 nestlings with good success.

Mossman (1976) used cattle ear-tags on vultures, but did not describe how the tags were attached or how the vultures responded to them. He marked six adult Turkey Vultures (*Cathartes aura*) that he trapped in Wisconsin; resightings of these birds were infrequent. Gaby, however, has used cattle ear-tags to mark more than 278 wild Turkey Vultures in Florida since 1977 (S. Gaby, pers. comm.). Although her cattle ear-tags have been on birds for several years and birds have been resighted frequently, only a few of her tagged birds have been reinspected closely because birds were not retrapped. The markers described here are similar to the tags used by Gaby, but we incorporate several important improvements.

### METHODS

The Delta Plastics Ltd. of New Zealand (G. C. Hanford Mfg. Co., P.O. Box 1055, Syracuse, NY 13201) makes a flexible, plastic, cattle ear-tag

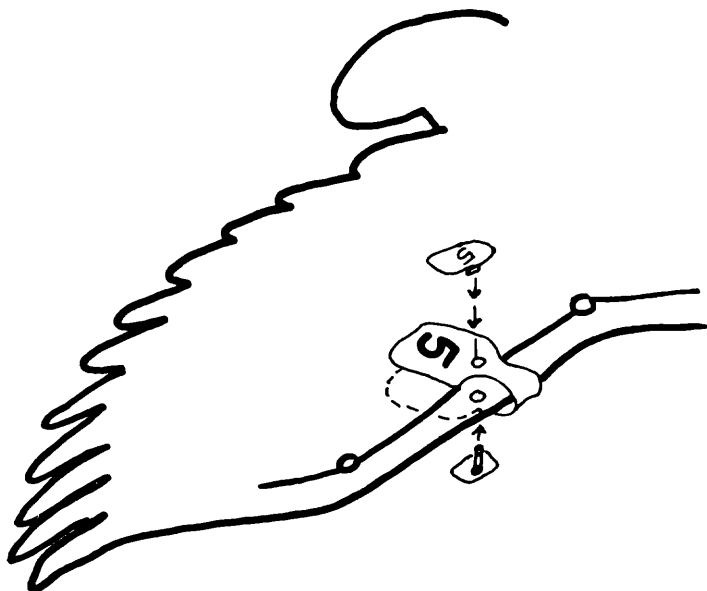


FIGURE 1. Diagram showing marker in place on a wing.

under the brand name Allflex. We attached these tags to the wings of vultures with a manufacturer-provided applicator that pierces a 7-mm diameter hole in the patagium as the tag is attached. The plastic tag also pierces vinyl streamers, one positioned beneath the top portion of the plastic tag on the dorsal wing surface and the other against the ventral wing surface secured by the bottom half of the rivet as diagrammed in Fig. 1. Vinyl for streamers is available from several companies (Nesbitt 1979).

To evaluate the cattle ear-tag system for marking vultures and condors, Wallace and Temple marked three Black Vultures (*Coragyps atratus*) and two adult Turkey Vultures and observed them in captivity for two to three weeks. The birds were neither concerned nor handicapped by the tags or vinyl streamers, although they occasionally preened around the area of the plastic rivet.

In 1978, the markers were put on 16 nestling Black Vultures and 15 nestling Turkey Vultures in Florida two weeks before they fledged. Since these birds were part of a captive-rearing and release program, their growth and behavior ontogeny were observed daily (Wallace and Temple *in press*). In North Carolina, Parker has marked 375 Black and Turkey vultures: 275 with wrap-around tags and 100 with cattle ear-tags.

#### RESULTS AND EVALUATION OF TECHNIQUES

*Visibility of markers.*—Contrast between the dark plumage of vultures and a light-colored vinyl streamer makes identification possible at great

distances, particularly with the use of binoculars or telescopes. Alpha-numeric codes painted on the streamers allowed individual recognition at closer distances, usually being easy to read on a soaring or slowly flapping bird. The markers remain visible when the birds are perched.

*Retention of markers.*—The manufacturers of Allflex tags claim they have no reports of numbers fading and that the tags remain in place for the life of the animal, which can be over 20 years in dairy cows. We have checked tags on four captive, one-year old Turkey Vultures tagged as nestlings; none of the cattle ear-tags or vinyl streamers showed signs of wear, and the birds' patagia and feathers were unaffected. Similarly, tags on wild birds that were retrapped showed no signs of wear after 12 months. We found no evidence of tag loss for at least the first 6 months after application to birds that were radio-tagged and observed repeatedly.

The portion of the vinyl streamer that is most likely to wear and possibly result in eventual loss is the point of attachment to the cattle ear-tag. This problem can be prevented by making the dorsal and ventral streamers from one piece of vinyl. By continuing the dorsal patch over the leading edge of the patagium with a narrow strip and joining this to the ventral patch, both upper and lower patches of the tag are locked into position (Fig. 1). This should prevent streamers from rotating around the cattle ear-tag shaft and, therefore, reduce the wear at that point.

*Streamer size.*—The first nestling Black Vultures released in the Florida study were marked with cattle ear-tags holding vinyl streamers of the same shape and size (23 × 10 cm) used by Gaby on her wild-trapped Turkey Vultures. Four observations indicated that this size was too large for Black Vultures:

1. Fledging of unmarked young vultures from control nests occurred about two weeks earlier than in the marked group of four Black Vultures. Another group of four Black Vultures marked with smaller (15 × 8 cm) streamers fledged on the same time schedule as unmarked controls in wild nests.
2. The large wing streamers of the first group were replaced with smaller ones, and within a day the birds were making normal flights. Prior to the streamer size reduction these four birds had never flown above the tree tops, whereas younger birds in the second group had already soared at high altitudes.
3. In instances where the line of flight of a marked fledgling was observed closely, we saw asynchrony in wing beat, suggesting the bird was off balance.
4. The shorter vinyl streamer does not flutter during normal flight, as does the larger size. It is too short to enter the most turbulent rear area of the wing on the dorsal surface; also, it does not leave the hollow of the ventral part of the wing and generally presses flat against that wing surface during level flight (Fig. 2).



FIGURE 2. Position and readability of marker during flight.

We feel tags should be kept as short as possible in both species, and care should be taken to avoid the turbulent area along the trailing edge of the wing.

*Possibility of injury.*—The 7-mm diameter hole in the patagium through which the tag passes presents no danger to the health or condition of marked birds. We reexamined the patagial holes of over 35 Black and Turkey vultures 2 weeks to one year after tag application. The punctures had healed with no signs of abrasion or wear. However, care must be taken when applying the tag to the wing not to make the puncture too near the tendon of the muscle located at the leading edge of the patagium or the muscle that runs along the radius-ulna (Fisher 1946).

*Wrap-around vs. cattle ear-tags.*—If one compares the cattle ear-tags and streamers attached to the patagium to wing tags simply wrapped around the ulna, the former have several advantages. The cattle ear-tags can be attached faster and are cheaper to use. Visibility is better because the cattle ear-tag anchor prevents the dorsal streamer from working its way between secondary feathers and being hidden from view on a perched bird, a common problem with wrap-around tags. The cattle ear-tag is more convenient to use in marking nestlings. The earliest age at which nestlings may be marked with wrap-around tags is 75 days, about 2 weeks before fledging, because fully grown flight feathers are needed to keep the vinyl tags in the proper position. Cattle ear-tags can be used on Black Vultures as early as 45 days after hatching, as soon as space on the patagium of the nestling can accommodate the tag.

An occasional problem we noted with cattle ear-tag markers in which the dorsal and ventral streamers were two separate pieces is that the streamers can pivot around the cattle ear-tag and flip over the front of the patagium. However, the tags soon flipped back into the correct position. The one-piece vinyl streamer secured by the cattle ear-tag (Fig. 1) would prevent this rotation.

*Effects on breeding success.*—Lockhart and Kochert (1979) note that wrap-around vinyl wing markers may adversely affect breeding success in Golden Eagles (*Aquila chrysaetos*). Eagles tagged as adults either aban-

done territories or were displaced by other birds. Such problems apparently do not occur in marked Black and Turkey vultures. When assessing the effect of a marking technique on breeding success, it is difficult to separate the relative effects of the capture and handling process, the time and place of capture, and the effect of the marker itself. The 14 breeding individuals (10 Black and 4 Turkey vultures) marked in Parker's North Carolina study were captured during all phases of the reproductive cycle, either with a handheld net at the nest or away from the nest in walk-in funnel traps. All birds were marked with yellow patagial tags, and three marked Black Vultures were subsequently recaptured to replace worn wrap-around tags with cattle ear-tags.

All young were fledged in eight Black Vulture nests and two of three Turkey Vulture nests where at least one adult was marked. Loss at the unsuccessful Turkey Vulture nest was due to predation and could not be attributed to the tagging method. All breeding Black Vultures marked for more than one season have returned to the same nest site and successfully fledged young.

*Effects on social status.*—It is impossible to measure accurately the effect of a wing marker on a social bird's status within a group unless the bird's status is known before it is marked. One indirect measure is to look at the outcomes of aggressive interactions between marked and unmarked birds. Social interactions are common among Black Vultures at roosts and feeding sites. From 1 April through 1 July 1979, 31 cases of aggressive interactions between marked and unmarked Black Vultures were witnessed at feeding and roosting sites. The outcomes were fairly evenly split; in 16 cases the marked bird fled, and in 15 cases the unmarked bird fled. Furthermore, marked birds initiate such interactions as frequently as unmarked birds, suggesting that marked birds are not persecuted because of their tags.

#### SUMMARY

Cattle ear-tags applied to the patagium of vultures serve as effective permanent markers and as safe anchors for colored vinyl streamers. If the tag is applied carefully and the streamer is of appropriate dimensions, marked vultures do not seem to be adversely affected.

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