

the general area of that part of the Gulf Coastal Plain." Freshwater conditions are certain because of the occurrence of catfishes, freshwater drum, gars, and sunfish (Swift 1968), and abundant frog material. The mammal fauna shows great diversity and probably indicates a concomitantly diverse habitat in the area. In addition, the occurrence of large tortoises (*Geochelone* and *Gopherus hexagonata*) certainly indicates at least milder winters than are known for south Texas today. Lundelius (1972) felt also that the age structure of *Tanupolama mirifica* indicated seasonality of a climatic factor, perhaps rainfall.

The Ingleside avifauna could be accounted for by the present-day ecological setting along the south Texas coast. Most of the species are known from the present-day south Texas fauna. It is difficult to assess the significance of the extinct stork *Ciconia maltha*, since modern storks occur in a wide variety of habitats and areas of the world. In the present-day fauna of south Texas, there is one stork (*Mycteria americana*) which occurs primarily in swamps, marshes, and ponds. The modern storks are typically warm climate, freshwater birds, but they may breed in more northern latitudes and migrate southward at the onset of cold.

I wish to thank Ernest Lundelius for placing the Ingleside specimens at my disposal and Larry D. Martin for helping in the identification of some of the fossils. The fossils were identified by comparisons with skeletons from the collections of the Museum of Natural History, the University of Kansas, and the collection of Pierce Brodtkorb, the University of Florida. Pierce Brodtkorb kindly criticized the manuscript.

TECHNIQUES FOR COLOR-MARKING HUMMINGBIRDS

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For most kinds of birds, color-banding is a convenient method of marking individuals for subsequent recognition in the field. Hummingbirds cannot be color-banded in the same manner because their very small, short tarsi make conventional bands impossible to see under field conditions. In the course of field work in California and Costa Rica, we have found two techniques for color-marking hummingbirds to be useful: painting spots on the upper back; and affixing a plastic tag to the leg. These techniques have enabled us to follow the movements and activities of individual hummingbirds in the field for periods of up to several years.

The first technique involves painting one, two, or three colored spots in a row across the upper back between the shoulders (fig. 1). During painting, the bird's body is held firmly against the index finger by the thumb and the middle finger securing the wings below the body (see fig. 1). In this way the bird is prevented from struggling, which in addition to dis-

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arranging the paint can easily result in a dislocated wing. We found Flo-Paque paint and Testor's or Pactra airplane dope to be about equally effective. It is important that the paint be fairly dry before the bird is released. This marking method works best for long-billed hummingbirds (e.g., *Phaethornis*) that cannot preen the upper back with the tip of the bill. Many shorter-billed hummingbirds will preen out much or all of the paint shortly after marking. However, if a bird fails to preen off the paint within a day or two, it will often ignore it thereafter, and the markings will frequently last until the next annual molt. This method of marking has been used successfully for periods of up to several months (Stiles, Univ. Calif. Publ. Zool. 97, 1972; Wolf and Stiles, Evolution 24:774, 1970).

The plastic tag technique is an elaboration of a marking method devised by Ortiz-Crespo (Unpubl. MA thesis. Univ. Calif., Berkeley. 1967. 161 p.), who attached plastic streamers of several types to the legs of Rufous and Allen (*Selasphorus* spp.) and Anna (*Calypte anna*) Hummingbirds in California. Ortiz was able to follow territorial occupancy of several individuals for up to 4 months, including one *Selasphorus* that left the study area and reappeared 3 months later. Compared to Ortiz's streamers, the plastic tags described here have the advantages of better observability and a greater number of possible color combinations. The technique may be somewhat more tricky to master, but a good tag can last for a year or more. The design of the tags and the method of affixing them to the bird's leg is shown in figure 2. The tag measurements given are for use on a 5- to 6-g hummingbird, and should be modified appropriately for use on larger or smaller birds. The

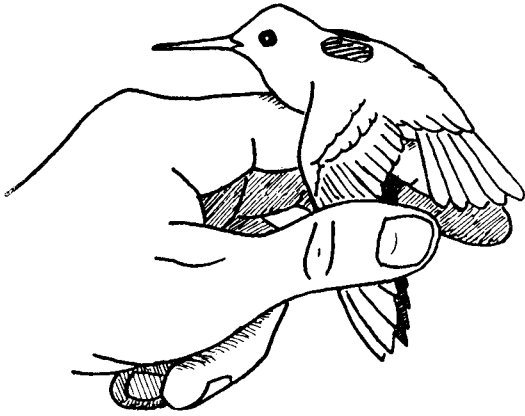


FIGURE 1. Position for holding hummingbird during application of back paint.

plastic we have used is colored acetate, which comes in translucent sheets in a variety of colors ("Roscolene" is a good brand). Tags should be stored flat and crimped (fig. 2c) just before being attached to the bird. The crimping forms the "tail" of the tag into a ring that fits around the bird's leg. The plastic should be thick enough for strength, but thin and flexible enough not to snap during the crimping process. The main requirements of the glue are that it must dissolve the acetate to give as strong and permanent a bond as possible, and that it be fast-drying. We have had best luck with Bond's Adhesive, but Duco Cement is fairly adequate. To get two- and three-color combinations, plastic tape can be added to the tip of the tag; Scotch brand tapes give the best service. (We have found no paint that will stick to acetate under field conditions.) Although potentially longer-lasting than back paint, tags may become brittle or bent, or glue may crack with age. It is important that the tag be able to rotate rather freely on the leg, and to slide up and down without passing over the foot or the tarsal joint. A tag that is too tight will cut off circulation to the foot and cause swelling, deadening, and eventually loss of the foot.

During our current studies in Costa Rica, we marked each bird with both back paint and a tag. The same color combination is used for both sets of markings; paint spots are read left to right across the back, tag colors were read from the base to the tip of the tag. Using both sets of markings gave us

CEDAR WAXWINGS IN CENTRAL ALASKA

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The Cedar Waxwing (*Bombycilla cedrorum*) reaches the northern limit of its range in extreme southeastern Alaska where it is an uncommon summer visitor (Gabrielson and Lincoln, *Birds of Alaska*, The Stackpole Co., 1959). In central and southern Alaska the

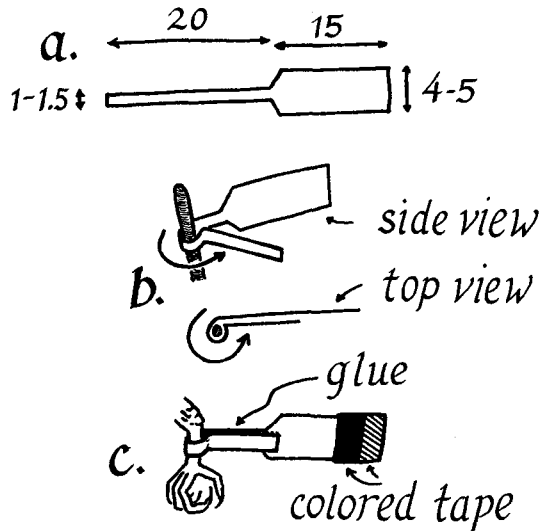


FIGURE 2. Design and method of attachment of plastic tag: a. dimensions of tag in millimeters; b. crimping the tag around some object of approximately the same diameter as the bird's leg; c. tag attached, showing placement of glue and colored tape.

a chance to identify the bird in the field from more different angles; the bird can lose one set of markings and still be identifiable.

As an added precaution, we measure bill, wing, and tail lengths of all birds we mark. Thus, if a bird is recaptured after it has lost most (but not all) of its markings, it can sometimes be identified by measurements.

The color-marking techniques we have described here do not appear to affect the behavior of the hummingbirds in any way. Territorial defense by male *Calypte anna* in California (Stiles, op. cit.) and *Panterpe insignis* in Costa Rica (Wolfe and Stiles, op. cit.) was unchanged by marking with back paint, and a female *Panterpe* similarly marked continued to carry on nesting chores in a normal manner (Wolf and Stiles, unpubl. data). Male *Phaethornis superciliosus* marked with both paint and tags have been repeatedly watched and filmed interacting normally with each other and unmarked bird on leks in Costa Rica; we have even observed copulations by marked birds.

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Bohemian Waxwing (*Bombycilla garrulus*) commonly breeds in forested areas and occurs in southeastern Alaska only as a migrant or winter visitor.

On 17 June 1969, while camped with a field party by Hess Creek at 65°42' N 148°35' W, a few miles upstream from its junction with the Yukon River, two of each species of waxwings were observed together near camp. The habitat where the birds were seen was spruce forest and willows, bordering an arm of the creek. In the evening both pairs were observed making "flycatching" flights from the tops of tall spruce trees. The close proximity of the two species made the differences between them very apparent. The Cedar Waxwing was smaller with whitish rather than rufous under-tail coverts. It