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FLIGHT RESTRAINT TECHNIQUES FOR CAPTIVE CRANES

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ABSTRACT

Traditional techniques for preventing escape of captive cranes (i.e., tenotomy, tenectomy, wing clipping, confinement under nets, and amputation) are discussed briefly. Two additional techniques (i.e., brailing and vane trimming) are described in detail. The advantages and limitations of each technique are presented.

INTRODUCTION

Many methods have been used to prevent escape of captive birds, including: (1) amputation (removal of all or a portion of the wing) (Young 1948; Schwarte 1965; Sedgewick 1967; Williamson and Russell 1971; Robinson and Buzikowski 1975; Osinskii and Taran 1978; Madill 1981; Wallach and Boever 1983; Amand 1986); (2) tenotomy (severing the extensors of the hand) (Schroeder and Koch 1940; Miller 1973); (3) tenectomy (removal of a portion of the extensors of the hand) (Schwarte 1965; Sedgewick 1967; Miller 1973; Amand 1986); (4) patagiectomy (removal of the patagial membrane and apposition of the radius and humerus) (Sedgewick 1967; Mangili 1971; Robinson 1975; Madill 1981); (5) functional ankylosis (fixing the ulna, carpal and metacarpal bones with stainless steel wire) (Sedgewick 1967); (6) wing (feather) clipping (cutting the distal portions of the primary and secondary feathers) (Young 1948; Schwarte 1965; Sedgewick 1967; Gandal and Amand 1982; Amand 1986; Harrison and Harrison 1986); (7) brailing (binding one wing) (Schwarte 1965; Zwank and Derrickson 1981; Amand 1986); and (8) confinement under nets. Radical amputation of the wing would also render birds flightless but is little used because captive birds are usually confined for propagation or display purposes, uses which presumably would be impaired by extensive mutilation.

In the following, we provide details of the methods in use to restrain approximately 300 cranes (about 40 whooping cranes *Grus americana* and 260 sandhill cranes *G. canadensis*) presently maintained at the Patuxent Wildlife Research Center (Center). Included is one method, brailing, used historically by falconers (Michell 1959), which has been adapted for our use with cranes, and a recently developed technique, vane trimming, which renders young cranes flightless from fledging age until they can be safely wing clipped (when their quills are fully grown).

METHODS IN USE AT THE PATUXENT WILDLIFE RESEARCH CENTER

We employ the following methods: (1) overhead nets, (2) tenotomy, (3) wing (feather) clipping, (4) vane trimming, and (5) brailing. Amputation, tenectomy, and patagiectomy are not in use at the center because less radical measures appear fully suitable in rendering birds flightless.

Netted Pens

Nets are used for birds that are intended for release or are intended to become full-winged captive breeders. We recommend nylon covered chain link pens for confining full-winged birds. At the Center we have 23 net covered pens varying in size from two small quarantine pens (30 x 50 ft; 9.1 x 15.2 m) to flight pens used for conditioning birds for release (100 x 30-50 ft; 30.5 x 9.1 – 15.2 m) and breeding pens (65 x 45 to 100 x 50 ft; 19.8 x 13.7 to 30.5 x 15.2 m). Vertical fences are typically 8-ft (2.4 m) tall. Nets are supported by 3/8-in (1 cm) plastic-coated steel cables crossing the pens at 20-ft (6.1 m) intervals.

We use 2-in (5.1 cm) mesh nylon nets and recommend this mesh size as a maximum. At the International Crane Foundation, birds held under nets with larger mesh are occasionally snared by the net and held suspended when one or both wrists pass through the mesh (G. Archibald and S. Swengel pers. comm.). Occasionally, when a bird springs up against the nets at the Center, it passes its head through the mesh and is momentarily held suspended. Sandhill cranes pull free under their own weight as do most whooping cranes. Rarely, however, a whooping crane is held suspended until pulled free by a caretaker. We have incurred no known injuries from these incidents, but we believe that this problem could be avoided by using a smaller mesh for whooping and other large cranes.

Netted pens offer the advantage of allowing birds to be full-winged and therefore presumably better able to

balance during copulation. Chances of reproducing naturally (without artificial insemination) are thereby increased. By 1990, five pairs of Mississippi sandhill cranes *Grus. c. pulla* housed under nets produced fertile eggs. We also maintain seven pairs of full-winged whooping cranes but only one pair has proven to be naturally fertile.

In cooler environments where snow or ice storms are likely, netted pens may collapse unless heavily braced. In February 1987, 15 of 23 netted pens at the Center collapsed under heavy snow. If a sufficiently large work force and sufficient temporary vertical support posts are available, it is possible to maintain netted pens during snow or ice storms.

Tenotomy

Tenotomy is used to permanently eliminate flight capability. This process involves using a thermo-cautery instrument (Figure 1A) to sever the *tendo longa* (terms after Baumel 1979) of the *musculus tensor propatagidalis* and the tendonous attachment of the *musculus extensor metacarpi radialis*. The destruction of the synovial capsule of the wrist (*junctura carpi*) results in permanent ankylosis. The operation should be performed with a local anesthetic. We infiltrate the site with 2-3 ml of 2% lidocaine HCl, wait 5 minutes before surgery, and freeze the skin surface with an ethyl chloride spray immediately before surgery. Young birds are typically tenotomized in the fall of their first year. In the weeks prior to the tenotomy, young birds are held flightless using one of the other methods. After tenotomy, the wing is taped tightly folded for six weeks to promote ankylosis.

About 5% of our tenotomized cranes are, in a strong wind, sufficiently capable of flight that they can vault an 8 ft (2.4 m) fence. To prevent escape of such birds we clip the primaries of the tenotomized wing at yearly intervals. The result of a successful tenotomy is a cosmetically pleasing bird (Figure 1B) that is sufficiently imbalanced because of the asymmetry of its wing surfaces to be unable to rise higher than 1-2 m even in a strong wing.

At the Center, we are currently investigating the role of wing condition on crane fertility. Although the study is still underway, about 50% of the tenotomized male Florida sandhill cranes *G. c. pratensis* in our captive colony were able successfully to fertilize eggs.

Wing Clipping

Wing clipping is used for birds that are to be held flightless for at least 3 years, but may be intended for flight thereafter. To wing clip a crane, the primaries and three or more of the distal secondaries from *one* wing are cut with scissors (Figure 1C). Typically, each rachis is cut about 1 inch (2.5 cm) from its point of emergence from the integument. Cranes living in windy areas (where they can achieve greater lift with the clipped wing), birds in pens with shorter fences, and those with exceptional escape capabilities are wing clipped even more extensively than illustrated.

Cranes at the New York Zoological Society facilities are clipped somewhat differently (S. Balzano, pers. comm.). The three most distal primaries are left intact, but all other primaries and approximately two-thirds of the secondaries are clipped. This variation reportedly allows male cranes to balance better during copulation.

When clipping, special care is taken to avoid cutting any feather that is still growing. Profuse and prolonged bleeding from the quill occurs if this precaution is not taken. To prevent cutting the rachis too soon, the wing is spread and the underside of the wing is inspected to identify blood quills. Feathers that are still growing are temporarily vane trimmed, as described below, and later clipped when hard-penned (fully grown and free of blood in the calamus).

Vane Trimming

Vane trimming is used temporarily to ground birds while their flight feathers (primaries and secondaries) are still growing. Once the flight feathers are hard-penned, the rachis is clipped.

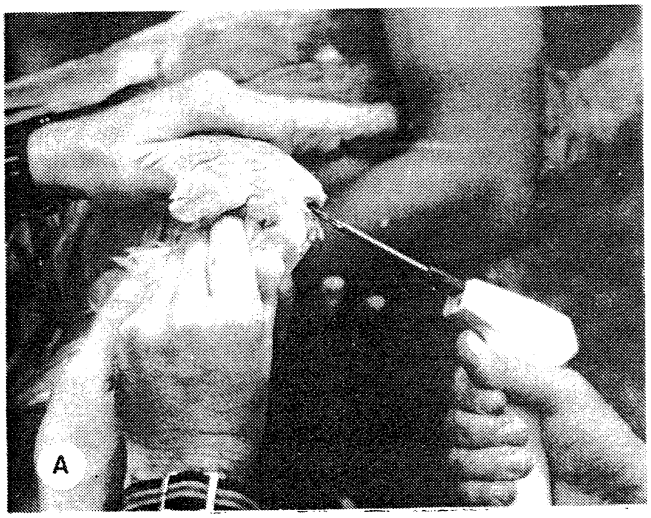
In this process (Figure ID) a portion of the vanes of the primaries and the distal three to six secondaries of one wing are trimmed with scissors. The rachis and the feather tip is left untrimmed to prevent birds in social groups from striking pen mates with sharp rachis tips. As illustrated, the outer vane of the five most distal primaries is left intact to prevent breakage of the rachises. Once a feather is hard-penned, it is clipped as shown in Figure 1C. Those chicks that are later to be wing clipped or tenotomized are vane trimmed at 60 to 70 days of age depending on individual growth rates and local conditions.

Brailing

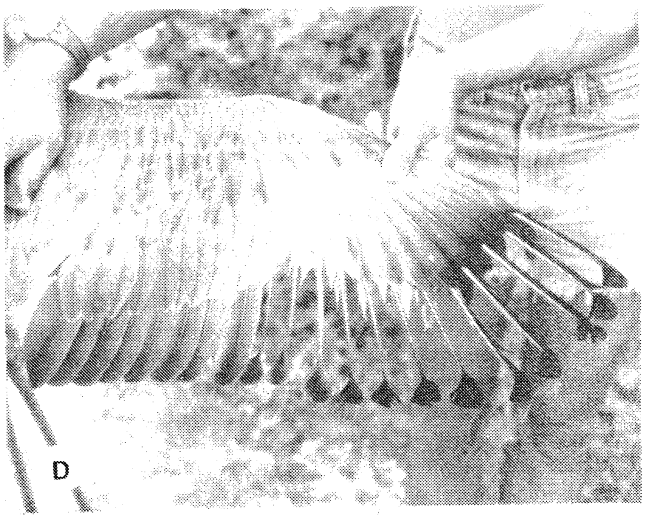
This technique is used for temporarily restraining fledglings (that are to be later placed in flight pens or released), flighted adults, and birds during shipment. At the Center we rear many chicks in open pens with tenotomized or wing-clipped foster parents. As chicks approach fledging, they are inspected to determine when flight restraint is necessary. Chicks that are to remain full-winged (flighted) are placed in netted pens or brailed at about 60 to 65 days of age. The age of first brailing varies a few days depending on individual development, propensity to fly, and wind conditions.

Shipped birds are sometimes brailed on each wing. For other purposes, birds are brailed on one wing for two weeks at most, then rebrailed on the opposite wing. Brails are changed at regular intervals to prevent ankylosis of the immobilized wing. Epperson (1982) found significant but reversible impairment in wing extension capability in birds brailed only two weeks. Typically, birds regained full flight capability within 1 to 2 weeks of removal of the brail.

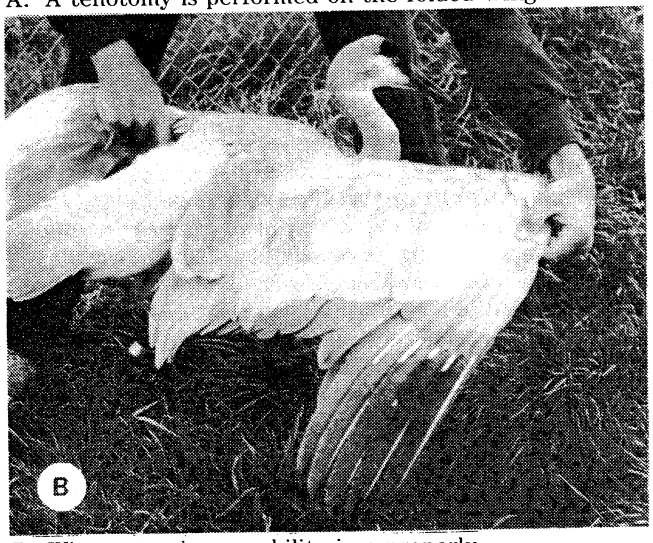
The procedure requires a brail and a riveting device. For the brail, we use a narrow band of flexible plastic 3/4 x 15 in (2×37.8 cm) wide and approximately 1 mm thick. To secure the brail, we use a commercially available rivet gun. Leather straps and other riveting or sewing devices can be readily substituted as long as the following conditions for proper fit are met.



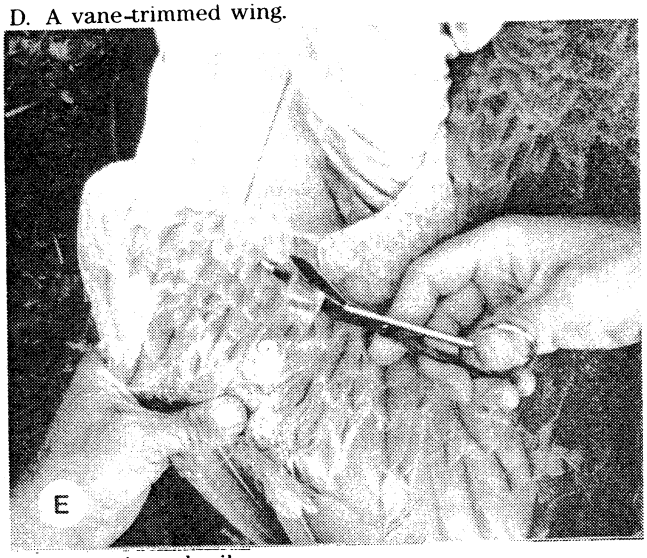
A. A tenotomy is performed on the folded wing with a



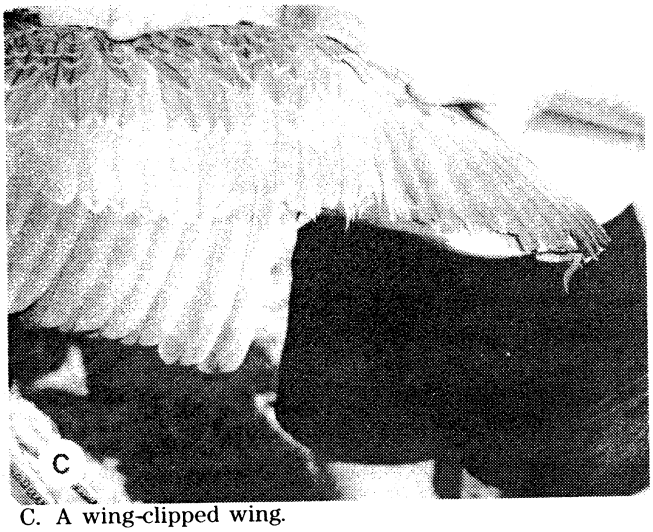
D. A vane-trimmed wing.



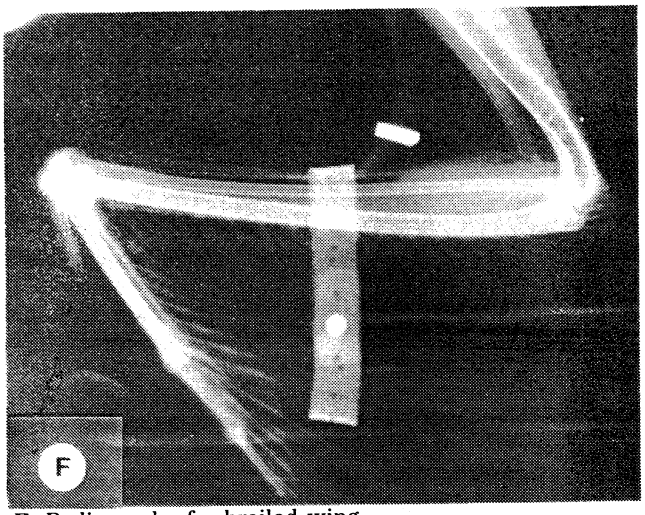
B. Wing extension capability in a properly tenotomized bird.



E. Removing a brail.



C. A wing-clipped wing.



F. Radiograph of a brailed wing.

Figure 1. Flight restraint in cranes.

When brailing a crane, one caretaker holds the bird immobile while a second inspects the wing to be certain that less than 4 cm of the rachis of each primary is still in the blood. If the blood filled zone in some of the quills is more extensive than 4 cm, brailing is postponed to avoid damage to the growing feathers. If the bird is ready to be brailed, the brail is inserted between the bases of the third and fourth most distal primaries (numbers 7 and 8), and the strap is formed into a loose loop over the patagium. Alternately, rather than being inserted between the primaries, the brail loop may enclose all 10 of the primaries. With the wing folded, the rivet, with one washer on the shaft, is placed through two of the pre-drilled holes in the brail. Probing upward with the free hand, a path is opened for the rivet to pass between the feathers and through a third hole in the brail on the underside of the wing. The loops above and below the rivet should be about equal size. The washer is placed on the rivet and fastened. The trailing end of the brail should point downward and be trimmed in a convex arc to within 3 cm of rivet. To remove a brail, cut the upper loop (Figure 1E) and slide the brail off the primary tips. The final positions of the brail, rivet, and body parts are illustrated in Figure 1F.

Proper fit of the brail is important. If the brail is too loose it will slide toward the humerus until the primaries are free; if too tight, it will restrict circulation in the wrist and hand. The fit is checked by placing two fingers beneath the brail on the dorsal surface of the wing in the upper loop. If the fingers slide under easily but snugly, a good fit has been achieved. If the caretaker's fingers do not slide easily under the upper loop, the brail is removed (and a new brail is fitted).

During the first 10 min or so after release, the bird usually strains at the brail, attempting to extend the wing, and preens vigorously at the site of the brail. After a few hours, however, the bird typically gives little attention to the brail.

At the Center, we have brailed over 120 cranes that were eventually released to the wild. Many of these have survived for years after release. Occasionally, a bird shows slight but long term impairment in its ability to extend the hand of one wing following an extended brailing period. Very rarely, either the patagium or the integument between the primaries is damaged by a brail. Only once has a bird been so incapacitated in hand extension that it could not be released.

CONCLUSIONS

Many techniques are available for temporarily and permanently restraining flight in captive cranes. In the 20 years that the Center has maintained cranes in captivity, we have settled on four techniques that we use routinely. In addition, a new technique, vane trimming, was first used in 1986. Most birds in our flock (including both cranes of endangered species that are intended for artificial insemination and nonendangered cranes that are used as research surrogates and foster parents) are tenotomized. Netted pens are routinely used for maintaining birds prior to release and are now experimentally in use to determine the importance of wing condition on natural fertility. Wing clipping and vane trimming are used for birds that are not intended to fly for 2 to 3 years, or for birds that will be tenotomized in the ensuing months. Wing clipping is also used for birds that are tenotomized but still capable of escaping pens. Brailing is used frequently for many purposes. These techniques are an integral part of the management of our crane colony.

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