

## Comparison of fatal bird injuries from collisions with towers and windows

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**ABSTRACT.** Birds killed by colliding with towers and windows were studied to describe the type and extent of injuries and, more precisely, to suggest the actual cause of death. A total of 502 specimens (247 tower kills, 255 window kills) were dissected, radiographed, and examined. Tower and window collision categories were further subdivided to consider age (subadult versus adult) and weight (<39 g, sparrow-size or smaller, versus > 39 g, cardinal size or larger) differences in injury and differential vulnerability. Injuries were classified as superficial, subdermal, or skeletal fractures. Comparisons of injuries between tower- and window-killed specimens indicate that the consequences of these two types of collisions are similar. Subdermal injuries were more severe in tower kills than in window kills. Subadults experienced more severe subdermal injuries than adult tower and window casualties. Among window kills, larger birds had more severe subdermal injuries than smaller birds. Collision victims may show blood or fluid in the mouth or nose cavities (30–60%), almost all have subdermal intracranial hemorrhaging (98–99%), and most lack any evidence of skeletal fractures (82–91%). Histological examination of the brain of two specimens revealed blood pools in the cerebrum and cerebellum. The extravascular bleeding in and around the brain is probably the actual cause of death in collision fatalities. Treatment to reduce brain edema if administered within 6–8 h shortly after impact can save some strike casualties.

### **SINOPSIS. Comparación de heridas fatales producidas por el choque contra torres o ventanas**

Se estudiaron aves que perecieron a causa de choques con torres o ventanas para describir el tipo y extensión de las heridas y sugerir, con precisión la causa de la muerte. Un total de 502 cadáveres (247 que chocaron con torres y 255 que chocaron con ventanas) fueron disectados, radiografiados y examinados. Los choques con torres y ventanas fueron posteriormente subdivididos para considera la edad (adulto vs. juvenil), peso ( $\leq 39$  g, tamaño de un pinzón o más pequeño vs.  $> 39$  g, o el tamaño de un cardenal o mayor), diferencias en las heridas y vulnerabilidad diferencial. Las heridas fueron clasificadas como superficiales, subdermales o fracturas esqueléticas. La comparación de las heridas en los cadáveres causadas por choques con torres o ventanas indicaron que las consecuencias de estos dos tipos de colisiones son similares. Las heridas subdermales fueron más severas en aves que chocaron con torres que con ventanas. Los subadultos experimentaron heridas subdermales más severas que los adultos tanto en choques con torres como con ventanas. Se encontraron además heridas subdermales más severas en aves grandes que en pequeñas, entre aquellas que chocaron con ventanas. Las víctimas de los choques mostraron sangre o fluidos en la boca o en la cavidad nasal (30–60%), y casi todas mostraron hemorragias subdermales intracraniales (98–99%); la mayoría no mostró evidencia de fracturas esqueléticas (82–91%). El examen histológico del cerebro de dos cadáveres reveló sangre en el cerebro y el cerebelo. El sangramiento extravascular y alrededor del cerebro probablemente fue la causa de la muerte de las aves que chocaron. Se pueden salvar algunas de las aves que han sufrido colisiones aplicando un tratamiento para reducir la edema cerebral entre las primeras 6–8 h. luego de ocurrido el choque.

*Key words:* collision injuries, cooling towers, glass, tower kills, window kills

Avian collision casualties are receiving increased attention for their effect on certain species and bird populations in general (Klem 1989, 1991; Shire et al. 2000; Erikson et al. 2001). Where annual avian mortality at solid elevated structures is estimated in the millions of individuals, the kill at plate glass, from small

garage panes to windows consisting of entire walls of multistory buildings, is in the hundreds of millions for the U.S alone (Banks 1979; Klem 1990a, 1991; Dunn 1993). The injuries, cause of death, and recuperation of window kills have been reviewed and described to an effective but limited degree (Klem 1990b). Here we quantitatively document and compare fatal injuries resulting from collisions with a concrete elevated nuclear power plant cooling tower and with plate glass windows, and provide a more specific explanation of cause of death. The findings provide additional mea-

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