National Wildlife Research Center Scientists Study Wildlife Hazards On and Near Airports

Wildlife Services’ (WS) National Wildlife Research Center (NWRC) is the only Federal research organization devoted exclusively to resolving conflicts between people and wildlife through the development of effective, selective, and socially responsible methods, tools, and techniques. The NWRC field station in Sandusky, Ohio, is dedicated to providing a scientific foundation for WS and Federal Aviation Administration (FAA) programs that reduce wildlife collisions with aircraft. Consequently, the scientists work closely with WS airport programs throughout the nation, the FAA, and the U.S. Department of Defense.

To be certified for commercial passenger traffic by the FAA, many U.S. airports are required to develop and implement a wildlife hazard management plan. The FAA strongly discourages any management practice that might create wildlife hazards at airports. NWRC scientists conduct research to provide guidance to the FAA, WS, and the general public regarding mitigation of wildlife-aircraft strike hazards. More specifically, NWRC research is focused on understanding the nature of wildlife hazards on and near airports; developing management methods and tools to reduce those hazards; and providing WS, airport personnel, and the FAA with information on the latest strategies for controlling wildlife hazards.

Applying Science and Expertise to Wildlife Challenges

Calculating Strike Risks for Different Bird Species. Bird collisions with aircraft (also known as bird strikes) cost the aviation industry more than $1 billion each year. Identifying which bird species pose the most risk to aviation may help airport managers develop targeted management methods and strategies. NWRC and the WS Aviation Hazards Program developed a model to estimate strike risks for different birds species. The model combines the relative hazard score (RHS) and bird strike frequency for common bird species found at airports. RHS is the percentage of total strikes for each species that results in damage, substantial damage, or a negative effect on the aircraft’s flight (e.g., delay, emergency landing). It provides an index of severity, but not frequency. Of the 11,364 strike records and 79 bird species studied, red-tailed hawks, Canada geese, turkey vultures, pigeons, and mourning doves pose the greatest risk (i.e., frequent and damaging collisions) to aircraft in the United States. Researchers encourage airport wildlife biologists to adapt the model to their airport-specific strike data and use standardized bird surveys, corrected for detection bias, to further prioritize management efforts at their airports.

Assessing Bird Avoidance of High-Contrast Lights. Birds frequently collide with man-made objects and vehicles. Lights have been suggested as a way to alert birds and minimize the chances of collisions. But little is known about what kinds of lights work best to deter birds–bird vision is different from human vision, and bird species also differ in how they perceive objects. In a recent study, Purdue University and NWRC researchers explored this issue. They used perceptual models to find out which LED (light emitting diode) lights were more visible to brown-headed cowbirds, based on the lights’ specific wavelengths and color differences (high chromatic contrast). The researchers then evaluated the birds’ response to the lights–avoidance, attraction or neutral–with a behavioral test. Individual birds were released into an area where they moved in a single direction and had to choose a left or right exit. One of the exist routes included a lit LED light, the other an unlit LED light. Findings suggest that brown-headed cowbirds significantly avoid exit routes with lit LED lights that have peaks at 470 nm (blue) and 630 nm (red), but do not avoid or prefer LED lights with peaks at 380 nm (ultraviolet) and 525 nm (green) or broad-spectrum (white) LED lights. Researchers note the findings are limited only to steady lights under diurnal ambient light conditions and a single bird species. However, the approach could be applied to a wide set of conditions and species. Identifying wavelength-specific lights for use as visual deterrents may help reduce bird collisions with stationary and moving objects.

Species Flight Maneuverability and Frequency of Bird Strikes. Bird strikes involve financial loss to commercial, civil, and military aviation worldwide and are a source of mortality for birds. Purdue University and NWRC researchers investigated whether certain biological traits of birds, such as their body mass (takeoff time and distance), eye size (visual acuity), brain size (cognitive ability), and wing
loading and wing aspect ratio (maneuverability), increased or decreased their risk of collisions with aircraft. Wing loading is the ratio of body mass to wing area and reflects the wings ability to turn relative to the bird’s body. Models comparing the traits of 93 bird species with bird strike frequency showed that birds with greater maneuverability (i.e., lower wing loading) had a higher frequency of bird strikes. Examples of bird species with greater maneuverability include swallows and songbirds. Bird species with lower maneuverability include waterfowl and raptors. Researchers speculate that species with greater maneuverability may fly slower and take off at shorter distances to avoid aircraft. They may also be hazed less than other more obvious species at airports given their smaller body size and people’s belief that they cause less damaging bird strikes.

Wildlife Strike Damage to Rotary-Wing Aircraft. Rotary-wing aircraft (i.e., helicopters and tilt-wing aircraft) make up an important part of military and civilian flights. NWRC researchers analyzed the damage rate, airframe models, and impact locations on rotary-wing aircraft associated with 4,256 wildlife strikes from 1990 to 2011. Birds and mammals (mainly bats) accounted for 93 percent and 7 percent of the wildlife strikes, respectively. Although all parts of civil and military rotary-wing aircraft had damage from wildlife strikes, some specific areas had more damage than others. Researchers recommend that airframe manufacturers and maintenance personnel consider reinforcing and redesigning rotary-wing aircraft windscres and main rotor systems to better withstand the impact of a wildlife strike.

Reducing Airplane Collisions with Large Mammals. Many large mammals are attracted to airports because of their surrounding habitats. Giving airport managers options for alternative land cover on and near airports may help reduce mammal-airplane collisions. To explore these options, NWRC, Mississippi State University, and University of Georgia researchers compared white-tailed deer and coyote use of two experimental fields: one with mixed native warm-season grasses and one with switchgrass (Panicum virgatum). Observing the fields via remote cameras, researchers found that coyotes and deer used the switchgrass field much less than the mixed native warm-season grass field—27 percent and 51 percent less, respectively. Considering that deer and coyotes are among the most hazardous mammal species to aircraft, fields of switchgrass may be a better alternative land cover. Researchers plan further studies to compare deer and coyote use of switchgrass to more traditional airport land covers, such as turf grasses and row crops.

Avian Radar for Tracking Birds at Airports. Avian radar technologies have the potential to track bird movements and activity at airports. However, the capabilities and limits of these technologies are relatively unknown. NWRC, WS Operations and University of Illinois experts evaluated the efficacy of three X-band marine radar sensors for tracking birds and flocks of birds at Chicago O’Hare International Airport. Researchers used field observations to determine how often the radar sensors gave corresponding information on bird targets. In total, there were 972 sightings of individual birds or flocks on the airfield. Of these, 143 (15 percent) were tracked by at least 1 radar sensor. All confirmed tracks of individual birds or flocks were 4.8 km or less from the radars. Larger bodied birds, birds/flocks flying at higher altitudes, and birds/flocks flying closer to the radars increased the radars' ability to detect and track them. When using avian radar to detect and track birds, wildlife managers could best apply this tool by placing the radar system within 4 km of the landscape, habitat or bird's suspected flight path.

Selected Publications:

Major Research Accomplishments:
- WS research discovered that red-tailed hawks, Canada geese, turkey vultures, pigeons, and mourning doves pose the greatest risk (i.e., frequent and damaging collisions) to aircraft in the United States.
- WS research determined that brown-headed cowbirds avoid lit LED lights that have peaks at 470 nm (blue) and 630 nm (red) wavelengths.
- WS research showed that smaller more aerially maneuverable bird species are struck by aircraft more frequently than larger species and might contribute significantly to strike risk.
- WS research determined that birds and mammals (mainly bats) accounted for 93 percent and 7 percent of the wildlife strikes with rotary-winged aircraft, respectively.
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