Reducing bird-related tragedy through understanding bird behavior

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William & Mary professor John Swaddle studies zebra finches to understand bird behavior. Credit: Stephen Salpukas/William & Mary

Bird-human actions can end in tragedy—for bird as well as human.

John Swaddle believes technology and a solid understanding of bird behavior can make those tragedies less frequent.

Swaddle is a behavioral biologist at William & Mary. He briefed attendees at the annual meeting of the American Association for the Advancement of Science on developments in a pair of initiatives designed to minimize unpleasant results of bird-human interactions.

The story of bird-meets-human too often ends in tragedy, he said. Birds descend on ripening crops, increasing the prevalence of human hunger and even starvation. At the same time, birds are killed by flying into buildings, cell towers and wind turbines. Bird strikes to aircraft can be deadly for both human and bird.

The two initiatives use acoustic deterrence to mitigate the human-bird tragedy. Both Sonic Nets and Acoustic Lighthouse make use of technologically advanced hardware. But Swaddle stresses that each project rests on the conceptual bedrock of a thoroughly researched understanding of bird behavior.

"The fundamental knowledge of how birds behave and respond to sound helps us derive these new technologies and solutions," Swaddle said. He discussed the two projects in a session titled Applying Insights from Animal Behavior to Address Global Challenges.

Sonic Nets uses sound to make gathering birds uncomfortable enough to leave an area where birds are not wanted. It's a proven technology, currently in use in a number of locations where birds have been a problem. Acoustic Lighthouse is the newer of the two ideas, aimed at reducing the number of birds that die from collisions with human-built structures.

A 2017 paper in the journal *Integrative and Comparative Biology* by

Swaddle and former William & Mary graduate student Nicole Ingrassia demonstrated proof of concept for the Acoustic Lighthouse idea.

Swaddle said death by wind turbine claims millions of birds each year. If you add in the birds colliding with cell towers, tall buildings and other products of modern life, the count goes up to billions.

"We know that there's a risk to bird populations. That risk is not evenly spread across the world. It's concentrated in certain areas, because wind is concentrated in certain areas," Swaddle said. "That's where the wind turbines are—and that's where bird movement are sometimes concentrated, especially during migration."

Virginia is an excellent case study site, and William & Mary is located in the Eastern Flyway, a major bird migration route with endpoints in the Arctic and the tropics. It's also prime siting for wind turbines.

"There's a lot of interest in developing near-shore or offshore wind energy. Putting large, rotating structures that look like mincemeat-makers in the sky isn't going to be good for the birds," Swaddle said.

The idea behind Acoustic Lighthouse is simple: get flying birds to look up. Swaddle explained that a bird in flight aligns its body in a horizontal plane for optimum aerodynamics. Plus, most birds have eyes located on the sides of their skulls. These anatomical facts of life means a migrating bird is looking down, and not where it's flying.

When downward-looking bird meets immovable object, the bird never knows what it hit. Swaddle says many people will pick up a window-strike victim, see the wobbling head and render a verdict of broken neck. In reality, the birds are much more likely to have suffered immediate, fatal brain injury, he said.

Acoustic Lighthouse technology consists of a directional speaker mounted on a wind turbine or other structure. The speaker projects a sound that alerts approaching birds and prompts them to slow down, look ahead—and fly around the turbine or tower.

Swaddle said cruising birds slow down just like birds in cartoons, lowering their tail feathers to force their body from the horizontal plane to a more vertical position.

"All that's missing is the brake-screeching sound," he said. A slowing bird's altered posture will naturally cause it to look up, see danger ahead and alter course—once it hears the signal.

"It's a bit like someone texting while they're driving," he said. "If you honk your horn at them, they'll look up."

The second technology Swaddle discussed, Sonic Nets, was developed as part of a collaboration that includes Mark Hinders of the William & Mary Department of Applied Science. Sonic Nets is more fully developed technology that received early-stage funding from the Bill & Melinda Gates Foundation through its Grand Challenges Explorations program.

Sonic Nets, like Acoustic Lighthouse, uses focused sound from directional speakers to modify bird behavior, but the projects are different in many respects. Acoustic Lighthouse is for flying birds, but Sonic Nets is designed for problems that stem from gatherings of birds.

The Sonic Nets speakers project a sound that is designed to disrupt the chatter of gathering birds. Swaddle explained that flocking birds rely on each other to keep watch for danger. The "pink noise" emitted by Sonic Nets masks the avian chatter, making the birds unable to hear predator cues and alarm calls which causes birds to leave the fields of ripening

crops, parking lot, airport or any other area where Sonic Nets is deployed.

"The idea is that we're broadcasting sounds that maximally interfere with the way birds communicate with each other," Swaddle said. "If birds can't talk to each other, their perception of the threat of the area—the predation risk—goes way up. So birds don't like being in that area."

In terms of danger avoidance, Sonic Nets offers birds the equivalent or humans choosing to go down a well-lighted road over a dark alleyway, Swaddle says. The birds are choosing to go to a place that's not acoustically busy.

Sonic Nets is being commercialized through a partnership with Midstream Technology. A number of Sonic Nets installations have been deployed on three continents.

"We've gone all the way to full commercialization and we seem to be having particular success with agriculture," Swaddle said. "We have shown in lab and field that the sound displaces birds from that area and, importantly, seems to save a long-lasting effect. Habituation has been a continuous bugbear of the bird-deterrent industry but we don't have that issue with Sonic Nets because we are manipulating the real threat of predation in the area."

More information: John P. Swaddle et al, Using a Sound Field to Reduce the Risks of Bird-Strike: An Experimental Approach, *Integrative and Comparative Biology* (2017). DOI: 10.1093/icb/icx026

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