Getting birds to look where they're going

August 7 2017, by Joseph Mcclain

John Swaddle believes that his Acoustic Lighthouse can save thousands, maybe millions, of bird lives by giving birds the equivalent of a horn honk to a distracted driver. Credit: Joseph McClain

John Swaddle believes he can save a lot of birds just by getting them to look up.

One reason that birds fly into buildings is that they're not looking where they're going. They really can't, because they're not built that way.

In the first place, Swaddle says, most birds have eyes on the sides of their skulls. This anatomical arrangement gives birds a wider field of vision than eyes-in-front species like humans and it helps birds avoid

predation. But the trade-off is that birds don't have our extent of binocular overlap, a feature that gives humans superior depth perception.

Swaddle, a professor in William & Mary's Department of Biology, says it gets worse: During long flights, most birds might as well be flying blind.

"Birds put themselves in a body position to optimize flight and minimize drag," he explained. "In order to fly as quickly as they can while expending the least amount of energy, their horizontal body position means that their field of view is angled toward the ground. That results in a flying bird essentially looking down and to the side as it's flying—and not right to the front."

Mix these avian-anatomy facts of life with a spinning wind turbine or a glass-fronted building looming smack dab in the middle of a flyway and the inevitable result is a large number of many dead birds.

"It's been estimated that a billion birds a year die from hitting tall, man-made objects," Swaddle said. "For some populations, that's a very significant risk."

He explained that the jury is out on the worldwide conservation implications of bird-strike deaths. "Plenty of birds die during migration anyway," he said, but there is concern about the effects on endangered and threatened populations.

Swaddle said that virtually anything that flies is vulnerable—from eagles to hummingbirds, from swifts that zip through the air at 60 miles per hour to woodcocks that chug along at a sedate 10 mph.

That's where Acoustic Lighthouse can help. It's Swaddle's name for a developing technology that will project an audible alarm to alert birds

that they need to switch off cruise control and look ahead.

Swaddle explained that the downward focus of a cruising songbird is like someone driving a car while texting. The idea of Acoustic Lighthouse is to give birds the equivalent of a horn honk to the distracted driver, warning them that they're headed for a head-on collision.

Acoustic Lighthouse's proof of concept was demonstrated in a paper Swaddle and co-author Nicole M. Ingrassia M.S. '16 published recently in the journal Integrative and Comparative Biology. Swaddle and Ingrassia worked with zebra finches, common lab-raised surrogates of songbirds.

They set up an artificial "flyway" of their own and trained the finches to fly up and down the corridor. Once the birds were accustomed to flying the length of the corridor, Swaddle and Ingrassia introduced a barely visible mist net as a visual challenge.

Then, Swaddle explained, they introduced at random a sound column—essentially a speaker aimed upward, placed in front of the mist net. The birds' reactions were tracked using high-speed video.

"We wanted to see if the sound would act like a horn to a texting driver," Swaddle said. "Does it attract the visual attention of the bird? Does it change the way they fly? Does it reduce the risk of them colliding with the mist net?"

A review of the video revealed that a large percentage of the birds flying through the sound column did indeed slow their flight speed—by more than half. And some birds were able to avoid the mist net completely after being alerted.

"So it does seem to be working at some primary level," Swaddle said.

"It's reducing the speed of the birds."

He noted that because of the scale of the flight corridor, the speakers were necessarily placed fairly close—half a meter—to the mist nets.

"If you want to apply this to a building or to a wind turbine, that kind of free-flying situation, you'd project the sound field fifty or maybe a hundred meters in front," Swaddle explained. "So when a bird enters that zone, it gets plenty of warning."

A fully realized application of the Acoustic Lighthouse concept on a tall building would consist of strategically placed, focused-beam speakers. Swaddle said the distance of the sound from the "target" would vary, according to the setting and the types of birds at risk. The sound would be aimed at the direction from which migrating birds are traveling and projected at cruising altitude.

"It would be mounted many stories high. People on the ground wouldn't hear a thing," Swaddle said. "People inside the building would be behind double-glazed windows and the sound would be projected away from them. They wouldn't hear a thing."

The sound itself doesn't matter much, Swaddle said, as long as it's within bird hearing range. He's thinking about sounds within 6-12 kilohertz, the higher end of the avian audible range.

"It just has to be very conspicuous and somewhat novel to the bird," he explained. And a horn honk that alerts the texting driver would be a bad choice. "It can't be something that gets mixed in with the wind or traffic noises."

He added that even if a bird can't completely avoid collision, it might save itself from death, injury or even stunning just by reducing its air

speed. An obvious benefit is from the sheer physics of hitting a solid object at a lower airspeed, but Swaddle explained that the very act of slowing down puts a bird in a posture that increases its odds of bouncing off and flying away.

"We found that the alerted birds would slam on the brakes," he said. "When they're flying, they're fairly level. But when they slam on the brakes, they tilt their body down and they wrap their tail around. Imagine a bird landing: It's that kind of posture."

The hit-the-brakes posture means that the collision is less likely to be head first as the bird takes most of the impact on its feather-padded chest.

"If a bird hits straight-on with its skull, it's going to be damaging and potential fatal," Swaddle explained. "If a bird hits in a more vertical orientation, it's much more likely to bounce off and survive."

Swaddle believes that Acoustic Lighthouse can help to alleviate conflicting environmental concerns about the serious bird toll of wind turbines. He gave the example of golden eagles and bald eagles.

"There's been some situation in which a single eagle has hit a wind turbine and the penalties associated with that have shut down that wind farm for weeks on end," he said. "And the energy companies have to pay a large fine."

And, he said, Acoustic Lighthouse also reduces the conflict between bird conservation and economic development.

"We're not going to stop living in skyscrapers," he said. "We're not going to stop using electricity and so we need to find ways to live with wildlife more sustainably."

Provided by The College of William & Mary