Watch hummingbirds ‘dance’ through waterfalls

By **Lucy Hicks** | Aug. 18, 2020 , 7:01 PM

Starlings, swifts, and small birds called dippers build nests in the most unlikely places: behind the powerful curtains of waterfalls. But how they penetrate the pounding streams to reach their safe havens has long been a mystery. Now, research reveals just how small fliers can traverse these splashy obstacles—and how the waterfalls could protect against another threat: blood-sucking bugs.

To understand the physics of waterfall crossing, scientists turned to hummingbirds. Although the little buzzers don’t typically pop in and out of falls, they are close relatives of waterfall-nesting swifts and easier to work with in a lab because of their smaller size.

First, the researchers built a 54-liter flight chamber, with a feeder on one side and a perch on the other. Separating them was a 3-millimeter-thick artificial waterfall, created with a small water jet and pump. It was much smaller than what birds might encounter in the wild, the researchers note, but its flow was stronger than extreme rain. The scientists then filmed four Anna’s hummingbirds (*Calypte anna*) as they attempted to traverse the cascade to reach the perch.

All **crossed without much trouble**, the team reports today in *Royal Society Open Science*. But what surprised the scientists was the birds’ unexpected approach, says Víctor Ortega-Jiménez, a biologist at Kennesaw State University, Kennesaw, and lead author of the study. The birds did not speed up, fold their wings, and pass through the water like a bullet, as he expected. Aside from one bird that entered the waterfall head-on, the rest slid in sideways, parting the falling water with one wing before passing the rest of their body through (as seen above). “Nothing in the literature could predict that,” Ortega-Jiménez says.

By entering the water laterally rather than head-on, the birds can part the cascade while continuing to propel themselves from one side to the other, the scientists propose. “One wing is always generating thrust, while the other wing is in water,” adds David Hu, a Georgia Institute of Technology mechanical engineer and biologist who was not involved with the study.

To see how even smaller fliers fared, the scientists caught and tested house flies, green bottle flies, and one crane fly. For the insects, the journey across the waterfall (this time to a bug light) was far more treacherous. The water sheet quickly swept all eight of the tiny fruit flies to the bottom of the cage to their death. The artificial fall also overpowered the crane fly, stymied by its long legs and slow flying. Although seven bottle flies and house flies managed to make it to the other side, all but two crashed immediately after their feat.

For the bugs, the waterfall poses several challenges, Hu says. The first is simply breaking the surface tension to get through. “If you are small enough, you will bounce off like a trampoline,” he says. And once a bug is through, it still needs enough momentum to fly forward, despite the downward force of the water. Finally, water droplets can weigh as much as a bottle fly, Ortega-Jiménez says, which can easily drag the bug down to a watery grave.

That means cascades could serve as a protective barrier to nesting birds, keeping their chicks safe from not only large birds like raptors, but also blood-sucking bugs and other parasites. Ortega-

Jiménez next plans to analyze this waterfall-crossing behavior in swifts, using drones to follow these agile birds in the wild. That is, assuming the drones survive.

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