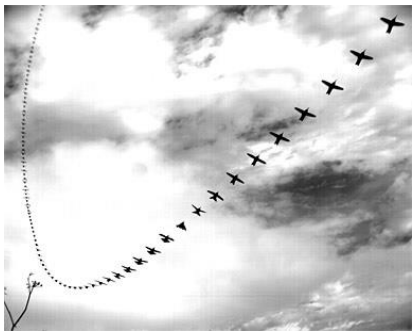
ScienceWatch- Fluttering Feathers Fan Affection

"In some cases it's just one tail feather vibrating, in some it is two hitting each other, and in some all the tail feathers are involved." – C. Clark

Every birder has at one time or another been dazzled by the iridescent, flashy colors of a male hummingbird. However, the showy display during his aerial maneuvers is not the only thing a female hummingbird notices. In some species when males dive in front of observing females during their courtship flights they also produce high-pitched squeaks or chirps. In 2008 two graduate students Christopher Clark and Teresa Feo at UC Berkeley's Museum of Vertebrate Zoology, Berkeley, CA, showed that tail feathers produce the squeaks.

But it wasn't clear exactly how these sounds were produced. So Clark, now at Yale University, New Haven, CT, and his colleagues plucked rectrices, the stiff tail feathers used to control flight direction, from 14 hummingbird species and subjected them to various air speeds in a wind tunnel. They used a Scanning Laser Doppler Vibrometer, which measures the vibrations of a surface, and high speed videos to observe the fluttering feathers in the wind tunnel. The results, published in the September 9, 2011 issue of *Science*, show that the squeaks come from tail feathers that vibrate only when the bird is at top speed near the bottom of his power dive.



For example, male Anna's Hummingbirds (*Calypte anna*) climb to 30 meters (100 feet) or more, and then dive at speeds of over 23 meters per second (50 miles per hour). At the bottom of their dive the birds produce a loud chirp.

When Clark *et al*., placed individual tail feathers in the wind tunnel and gradually increased airflow, they found that male hummingbird feathers began vibrating and producing sounds at wind speeds corresponding to normal dive velocities. The sound frequencies produced in the wind tunnel matched what was observed during a courtship dive. Once the critical air speed was reached, increasing it made the sound louder, which also happens when males speed up their dive.

In certain instances the researchers found that neighboring feathers amplify sound by sympathetic vibrations. For example, while the outermost tail feather, R5, in the Black-chinned Hummingbird (*Archilochus alexandri*) produced a sound, the adjacent tail feather (R4) tested at the same wind speed did not. However, placing R4 next to the vibrating R5 feather in the wind tunnel yielded sympathetic vibrations in the otherwise silent feather, which increased the volume of the sound produced by the R5 feather alone. Similarly, removing R4 from a diving male bird decreased the volume of its chirp.

Different species produced different sounds leading the scientists to conclude that each species has a signature sound, determined by physical factors intrinsic to the tail feathers. “The sounds that hummingbird feathers make are more varied than I expected”, said Clark. He speculated that the buzz-bombing displays resulted from sexual selection by females who began using the incidental sounds produced by feathers in flight to determine male fitness. The best flyers are the most fit and they make the loudest sound.

Co-author Richard Prum who has been investigating the realm of evolutionary aesthetics thinks it is much more straightforward than that. He believes that females have simply evolved to like a particular sound. He says, “What intrigues them will ultimately evolve, but what they will find intriguing is as unpredictable as next years fashions.”

Whatever the reason, it seems that a successful male hummingbird must be pleasing to the ear as well as the eye.

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