

Researchers reveal secrets of snake flight

May 12 2005

It seems size does matter after all. But for flying snakes, smaller is better, according to University of Chicago researchers.

In the May 15, 2005, issue of the *Journal of Experimental Biology*, scientists described the effects of size and behavior of flying snakes, and found that the smaller animals were better gliders.

"Despite their lack of wing-like appendages, flying snakes are skilled aerial locomotors," said lead scientist and author Jake Socha, Ph.D., who has been studying these unique creatures for the past eight years.

With the help of colleagues Michael LaBarbera, professor of organismal biology and anatomy at Chicago, and Tony O'Dempsey, an expert in photogrammetry, Socha used 3-D flight information from the synchronized recordings of two video cameras to digitally reconstruct the trajectories, speed and body postures of *Chrysopelea paradisi*, or paradise tree snake, and *Chrysopelea ornata*, golden tree snake.

In this study, Socha, who also is a biologist at Argonne National Laboratory, found that paradise tree snakes are true gliders, traveling further horizontally than dropping vertically. The best flight Socha recorded traveled 13 degrees from the horizon at the end of its trajectory.

Socha correlated 19 performance variables, such as glide angle and horizontal speed, of the snake's flight with 16 size and behavior variables, such as mass and snout-vent length, of the animal's body. He found that body length and wave amplitude are important predictors of

flight behavior, but wave frequency was not.

"These high-amplitude undulations visually dominate the behavior, yet their frequency is unrelated to the snake's glide performance," Socha said.

So why do they undulate? Socha and LaBarbera suggest it's for stability. Just as a person who makes small balancing adjustments while walking on a beam, a flying snake might continuously make adjustments to maintain controlled flight.

All other gliders, such as flying squirrels or lizards or gliding birds, maintain a constant wing structure, unlike these flying snakes that whip their bodies through the air. "Although all of these other animals may make small adjustments while gliding, none are as dramatic, rhythmic and dynamic as the flying snake," Socha said.

During his first study, published in *Nature* in August 2002, Socha described a few aerodynamic features of the paradise tree snake -- one of five snake species that are purported to "fly." He videotaped and photographed various snakes taking off from a 33-foot-high tower in an open field at the Singapore Zoological Gardens. He positioned two video cameras to record in stereo, enabling the 3-D reconstruction of the head, midpoint and vent coordinates of the snake throughout its trajectory.

Socha found that the snake uses its ribs to change its body shape; it flattens from head to vent. The snake takes control of its flight by undulating through the air in a distinctive S-shape as if swimming ✓ moving the tail up and down and side-to-side. While gliding, these snakes make turns up to 90 degrees and always seemed to land without injury.

The researchers now are looking more closely at the aerodynamic issues.

They plan to use physical and computer models to study the more complex kinematics of these gliders.

To collect and study these snakes, Socha traveled to Singapore twice and Thailand once with grants from National Geographic Committee for Research and Exploration.

Most flying snakes grow 3 to 4 feet long and live in the trees in the lowland tropical rainforests of South and Southeast Asia. Their temperament varies from species to species, and from individual to individual, but all five species of flying snakes are in the Colubridae family and officially are classified as harmless.

Flying snakes secrete mild venom that is only dangerous to their small prey. They are diurnal and opistoglyphous, or rear-fanged. These back teeth measure only 2 to 3 millimeters long and each has a small groove that runs along the fang's outer edge, where the venom drips down and into the prey. Whether or not the snake's choice of prey is related to its gliding ability is unknown.

Publication: jeb.biologists.org/content/vol208/issue10/

Source: University of Chicago Medical Center

Citation: Researchers reveal secrets of snake flight (2005, May 12) retrieved 20 September 2024 from <https://phys.org/news/2005-05-reveal-secrets-snake-flight.html>

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