# From crickets to whales, animal calls have something in common

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(PhysOrg.com) -- Scientists who compare insect chirps with ape calls may look like they are mixing aphids and orangutans, but researchers have found common denominators in the calls of hundreds of species of insects, birds, fish, frogs, lizards and mammals that can be predicted with simple mathematical models.

Compiling data from nearly 500 species, scientists with the University of Florida and Oklahoma State University have found the calls of crickets, whales and a host of other creatures are ultimately controlled by their metabolic rates — in other words, their uptake and use of energy.

"Very few people have compared cricket chirps to codfish sounds to the sounds made by whales and monkeys to see if there were commonalities in the key features of acoustic signals, including the frequency, power and duration of signals," said James Gillooly, Ph.D., an assistant professor in the department of biology at UF's College of Liberal Arts and Sciences and a member of the UF Genetics Institute. "Our results indicate that, for all species, basic features of acoustic communication are primarily controlled by individual metabolism, which in turn varies predictably with body size and temperature. So, when the calls are adjusted for an animal's size and temperature, they even sound alike."

The finding, reported in today's Proceedings of the Royal Society B, will help scientists understand how acoustic communication evolved across species, uniting a field of study that has long focused on the calls of particular groups of animals, such as birds.

The results also provide insights regarding common energetic and neuromuscular constraints on sound production, and the ecological and evolutionary consequences of producing these sounds.

"Acoustic signals are used to transfer information among species that is required for survival, growth and reproduction," Gillooly said. "This work suggests that this information exchange is ultimately governed by the rate at which an animal takes up and uses energy."

Animal communication is a long-studied area of biology, going back at least to the days of Aristotle. But generally the studies were species-specific, made in the context of courting calls or parental care of a certain type of animal — nothing to relate an animal call across a variety of species.

"From my perspective this is one of the first true attempts to provide a general theoretical framework for acoustic communication," said Alexander G. Ophir, Ph.D., an assistant professor of zoology at Oklahoma State, who began the painstaking process of compiling data on animal calls in hundreds of different species while a postdoctoral student at UF. "This seems to provide unifying principles for acoustic communication that can be applied to virtually all species. In terms of producing sounds, we use vocal cords, but other mechanisms of sound production exist, such as insects that rub their legs together. Until now, these sounds have been treated differently. But by providing a general mathematical framework — a baseline — we have a reference point to compare those differences.

"So if we say one animal's call is loud, we can provide a predictive reference point to say whether it is truly loud when compared with other animal sounds," he said.

That common reference point can even predict what animals long extinct

— think of Tyrannosaurus rex of "Jurassic Park" fame — may have truly sounded like.

"These findings say if you give me information about an animal of a certain body size and the mechanisms it uses to make sounds, I can give you a rough idea of what it sounds like," said Jeffrey Podos, Ph.D., an associate professor of biology at the University of Massachusetts Amherst, who did not participate in the study. "It allows us to imagine where the evolution of acoustic signals might go, and where it might have come from. Further study will probably put these principles in a more explicit evolutionary framework, but this is an interesting idea and presented with such a broad view. I can't think of anyone in at least 30 years who has tied together data from such a diversity of species. These authors are really trying to see the forest instead of the trees."

Provided by University of Florida