# Koalas' bellows boast about size

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Koalas have a well-earned reputation for being dopey. Sleeping 19 hours out of every 24, and feeding for 3 of the remaining 5 hours, there doesn't seem to be much time for anything else in their lethargic lifestyle: that is until the mating season. Then the males begin bellowing. Benjamin Charlton from the University of Vienna, Austria, explains that they probably bellow to attract females and to intimidate other males. But what messages could these rumbling bellows communicate about their senders? Charlton and an international team of collaborators publish their discovery that the koalas are boasting about their size in the *Journal of Experimental Biology*.

According to Charlton, they could be telling nearby listeners about their size. He explains that there was a possibility that koalas may be one of the few animals that have a descended larynx, which makes the vocal tract longer. Also, because all pipes – including vocal tracts – have frequencies where the air inside them vibrates naturally and amplifies sound, larger animals with longer vocal tracts produce lower resonances, giving their voices a more baritone quality. So, the longer vocal tracts of the largest koalas should produce deeper resonances to tell the listening koala audience just how big they are. Intrigued, Charlton, Tecumseh Fitch and their colleagues decided to find out whether male koalas have descended larynxes.

Teaming up with Allan McKinnon at Moggill Koala Hospital and Gary Cowin and William Ellis at the University of Queensland, Australia, Charlton investigated the anatomy of the marsupial's vocal tract. Using MRI and post-mortem studies, the team found that the koala's larynx had

descended to the level of the 3rd and 4th cervical vertebrae, instead of being high in the throat. They were also surprised to find that the muscle that attaches the larynx to the sternum was anchored very deep in the thorax and they suggest that it could be involved in pulling the larynx even further down into the chest cavity.

But what effect does the koala's deeply descended larynx have on the acoustics of their bellows? Travelling to the Lone Pine Koala Sanctuary, home to 140 koalas, Charlton patiently recorded their rumbling bellows. He also measured the animals' head sizes, with the help of Jacqui Brumm and Karen Nilsson, as skull size is a good proxy for body size.

Back in the lab, Charlton analysed the bellows' spectra and found that the largest males always had lower resonances than the smaller animals. More surprisingly, when Charlton calculated the koala's vocal tract length based on their acoustics, he was astonished to find that the koalas were able to make themselves sound as if they had 50-cm-long vocal tracts, nearly the entire length of the animal. In fact, the diminutive animals sound even larger than bison. Charlton suspects that koalas use the resonances of the oral and nasal tracts simultaneously to sound much larger than they are.

So, koala males are able to communicate their size, with the largest animals producing the richest baritone bellows. Charlton also suspects that the males' boastful bellows could have driven the evolution of their descended larynxes. 'Individuals that could elongate their vocal tracts by lowering the larynx may have gained advantages during sexual competition by sounding larger, and this would drive the evolution of laryngeal descent,' he says.

**More information:** Charlton, B. D., Ellis, W. A. H., McKinnon, A. J., Cowin, G. J., Brumm, J., Nilsson, K. and Fitch, W. T. (2011). Cues to body size in the formant spacing of male koala (Phascolarctos cinereus)

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