Evolution and significance of signalling traits in squirrels

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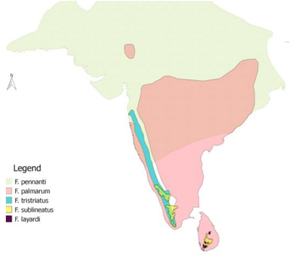
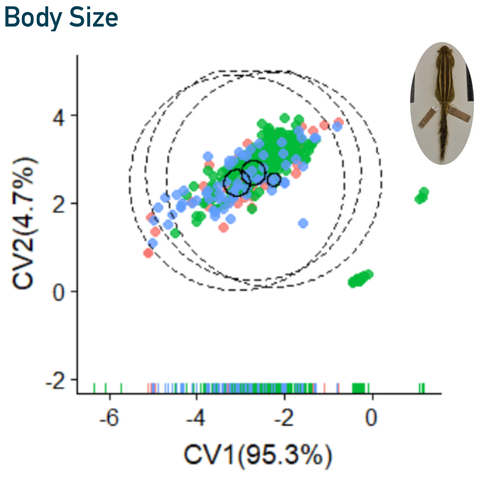
Species often evolve complex signalling mechanisms to communicate within and across species. These traits could have separate evolutionary histories, and understanding the adaptive roles of separate traits can be challenging. We examine the role of size, morphology, colour, and acoustics in squirrels through behavioural and quantitative approaches.

Tree squirrels in the Indian subcontinent: Funambulus and Ratufa

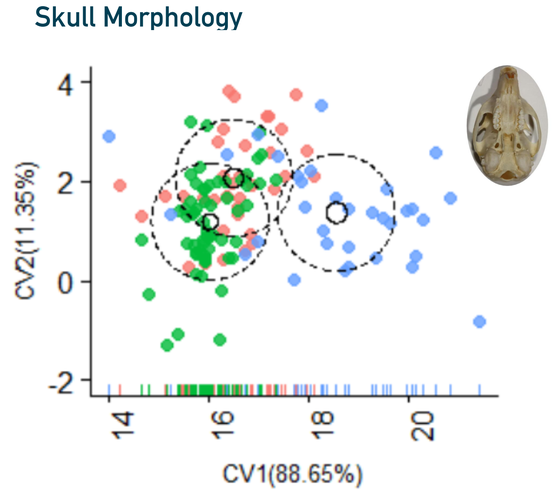


Signalling traits in three palm squirrel species: which traits are under selection?

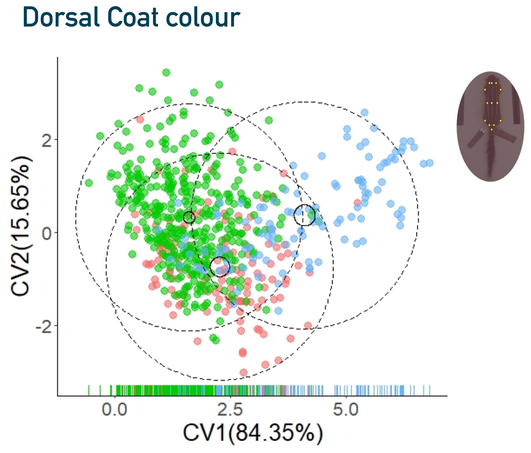
Body Size



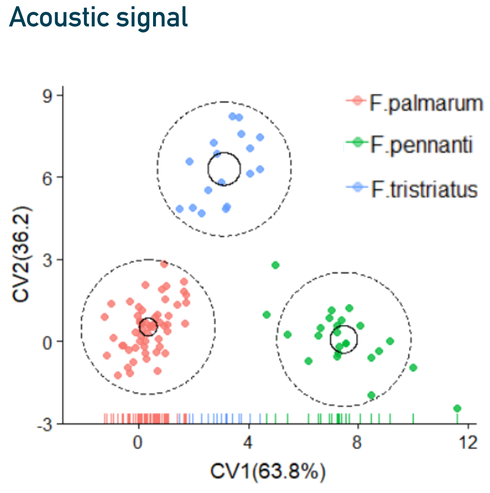
Skull Morphology



Dorsal Coat colour



Acoustic signal

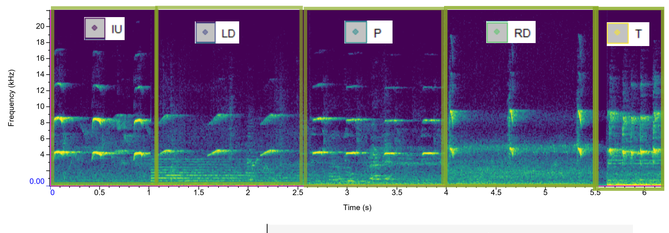


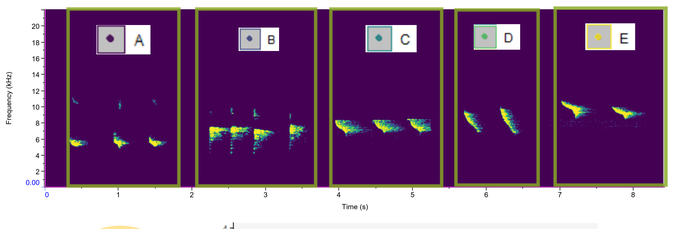
The three Funambulus species are very similar in their morphological (body size,skull and colour) characteristics. Acoustic features are species-specific, implying significance of acoustic trait evolution.

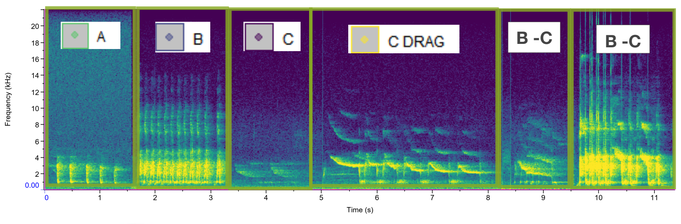
How complex are acoustic traits?

Visual classification:

Spectrogram of note type repertoire

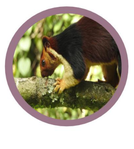


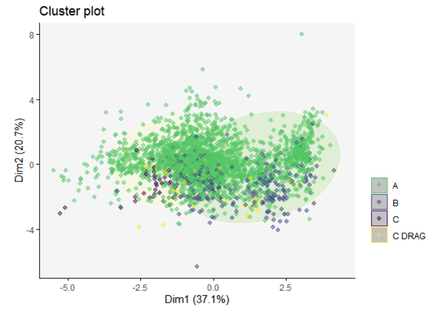




Spectral classification:

Fuzzy clustering using non-correlated spectral parameters



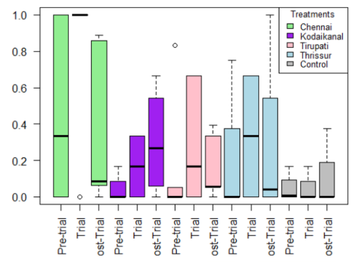


Note types of all species are graded in nature. The note types in the data can be optimally clustered into two groups using spectral parameters. Visual and spectral classifications are moderately similar.

Can acoustic signals explain behaviour?

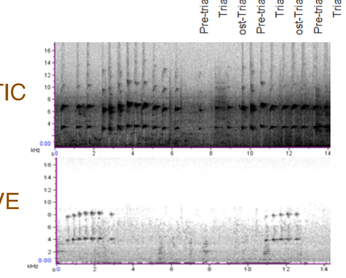
Do squirrels recognise and respond to the calls of their own species?

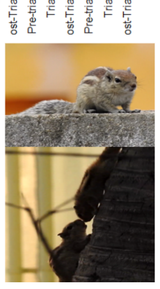
Palm squirrels vocally respond to acoustic signals of conspecific neighbours.



AGONISTIC

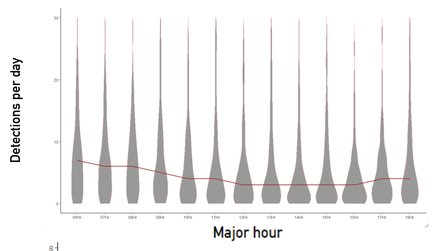
AFFILIATIVE

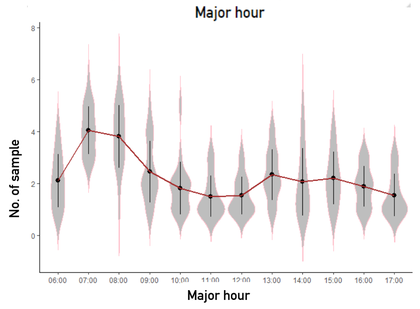




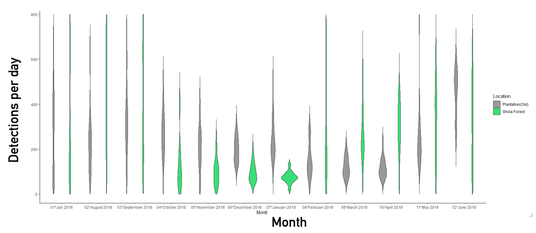
Can we use calling rates to infer behavioural peaks?: Automated recorders for large-scale monitoring

Hourly patterns of vocalisation





Annual pattern of vocalisation



No clear diurnal patterns emerge for Dusky squirrels. Also, dusky squirrels show different levels of vocalisations in different habitats. Giant squirrels are more vocal in the early morning hours. Further work might result in clearer patterns.

FUTURE DIRECTIONS

- Study evolution of species-specific traits, with special emphasis on the genomic aspects of colour and stripe variation
- Understand behaviour patterns like breeding periods and habitat use using long term automated recorders
- Study behavioural contexts associated with significant note/call types

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