Statistical analysis of routine behaviour in animal movement

Louise Riotte-Lambert [a,b], Simon Chamaillé-Jammes [a] and Simon Benhamou [a]

[a] Centre d'Ecologie Fonctionnelle et Evolutive
CNRS UMR 5175
1919 route de Mende
Montpellier, France

[b] Université Montpellier 2
2 place Eugène Bataillon
Montpellier, France

louise.riotte-lambert@cefe.cnrs.fr
simon.chamaille@cefe.cnrs.fr
simon.benhamou@cefe.cnrs.fr

Abstract:

Memory plays an important role in driving animal movement that still remains largely to be understood. When dealing with predictable resources, individuals can develop routine movement behaviour, by regularly revisiting known resource sites such as feeding patches, drinking holes or shelters. It has been acknowledged for a long time for foraging movement of nectarivorous insects and frugivorous primates, but an extensive number of species should rely on some degree of routine behaviour.

Fourier and wavelet analyses can be used to detect periodic revisits and thus to detect some sort of routine behaviour in time. However, we still lack methods and adequate metrics to better characterize the degree of routine spatial behaviour, to detect the repetition of movement sequences and determine which specific sequences are repeated, particularly when data are noisy and thus sequences are not *exactly* repeated.

Here we compare existing methods, developed in other fields, to detect repeated sequences. In particular, we consider a method developed for the detection of repetitions of behavioural sequences that iteratively pairs events when they follow each other within a time window significantly more often than expected by chance. Other methods considered include Markov models of transition matrices, recurrence plots, and algorithms used for the detection of repeated DNA sequences.

After conceptually comparing these methods we adapt the most appropriate for use on movement data, and we estimate the extent to which some animals rely on routine movement sequences to prospect their environment. We assess the degree of routine behaviour of several bird and mammal species. We look for the repetition of sequences of visits to specific feeding sites or water points, and investigate possible links with individual and environmental characteristics.