Agreement on the Conservation of Albatrosses and Petrels

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Identification of animal movement patterns using tri-axial magnetometry

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SUMMARY

Background: Accelerometers are powerful sensors in many bio-logging devices, and are increasingly allowing researchers to investigate the performance, behaviour, energy expenditure and even state, of free-living animals.

Another sensor commonly used in animal-attached loggers is the magnetometer, which has been primarily used in dead-reckoning or inertial measurement tags, but little outside that. We examine the potential of magnetometers for helping elucidate the behaviour of animals in a manner analogous to, but very different from, accelerometers.

The particular responses of magnetometers to movement means that there are instances when they can resolve behaviours that are not easily perceived using accelerometers.

Methods: We calibrated the tri-axial magnetometer to rotations in each axis of movement and constructed 3-dimensional plots to inspect these stylised movements. Using the tri-axial data of Daily Diary tags, attached to individuals of number of animal species as they perform different behaviours, we used these 3-d plots to develop a framework with which tri-axial magnetometry data can be examined and introduce metrics that should help quantify movement and behaviour.

Results: Tri-axial magnetometry data reveal patterns in movement at various scales of rotation that are not always evident in acceleration data. Some of these patterns may be obscure until visualised in 3D space as tri-axial spherical plots (m-spheres). A tag-fitted animal that rotates in heading while adopting a constant body attitude produces a ring of data around the pole of the m-sphere that we define as its Normal Operational Plane (NOP). Data that do not lie on this ring are created by postural rotations of the animal as it pitches and/or rolls. Consequently, stereotyped behaviours appear as specific trajectories on the sphere (m-prints), reflecting conserved sequences of postural changes (and/or angular velocities), which result from the precise relationship between body attitude and heading. This novel approach shows promise for helping researchers to identify and quantify behaviours in terms of animal body posture, including heading.

Conclusion: Magnetometer-based techniques and metrics can enhance our capacity to identify and examine animal behaviour, either as a technique used alone, or one that is complementary to tri-axial accelerometry.

This paper has an attachment:

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