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Applied Animal Behaviour Science 94 (2005) 117–131
APPLIED ANIMAL BEHAVIOUR SCIENCE
www.elsevier.com/locate/applanim

A new technique for monitoring the detailed behaviour of terrestrial animals: A case study with the domestic cat

Shinichi Watanabe [a,*], Masako Izawa [b], Akiko Kato [c], Yan Ropert-Coudert [c], Yasuhiko Naito [c]

[a] *Graduate School of Engineering and Science, University of the Ryukyus, Okinawa 903-0213, Japan*
[b] *Department of Chemistry, Biology and Marine Science, University of the Ryukyus, Okinawa 903-0213, Japan*
[c] *National Institute of Polar Research, Itabashi, Tokyo 173-8515, Japan*

Accepted 17 January 2005

Abstract

For many animal species that are difficult to access, the behaviour of free-ranging individuals cannot be assessed by direct observation. In order to remedy this, we developed a new technique using a motion detector (acceleration data-logger) for monitoring the activity and behaviour of free-ranging vertebrates and tested its efficiency on a domestic cat, *Felis catus*. A total of 3615 min of surging acceleration was measured along the longitudinal body axis of an adult male cat. The cat's behaviour was also filmed for 113 min, these video data being used to correlate the logger's signals with the cat's behaviour. Acceleration data-loggers attached on the cat's collar recorded acceleration signals which were influenced by both the gravitational acceleration resulting from the body posture and the dynamic acceleration resulting from the dynamic behaviour of the cat. By applying spectral analysis based on a fast Fourier Transform to acceleration signals, body postures and some of the dynamic behaviours of the cat such as drinking, eating, and several paces of travelling were efficiently determined. The present study shows that acceleration data-loggers represent a useful and reliable system for accurately recording the activities and detail behaviours of the terrestrial animals.

Keywords: Acceleration data-logger; Activity; Domestic cat; Motion detector; Time budget

* Corresponding author. Tel.: +81 9889 585 41; fax: +81 9889 585 76.
E-mail address: h063019@sci.u-ryukyu.ac.jp (S. Watanabe).

0168-1591/$ – see front matter
doi:10.1016/j.applanim.2005.01.010

1. Introduction

Assessing the activity of undisturbed animals is necessary to fully understand their ecology or to provide indices of their welfare, but this is often a challenging task. While this seems especially obvious when dealing with free-ranging, highly mobile or nocturnal species, the quantitative monitoring of the behaviour of captive individuals over long periods of time can be equally problematic.

Following the advances in electronics, there have been several attempts to automatically monitor the activity of animals using data transmitters or recorders directly attached to the animals. For instance, VHF radio transmitters have allowed researchers to track free-ranging animals, providing information about their movements (White and Garrott, 1990; Samuel and Fuller, 1996; Kenward, 2001). The addition of various sensors to the transmitters meant that several physical environments and physiological parameters could be monitored simultaneously with the position of the animals (Gillingham and Bunnel, 1985; Kunkel et al., 1991; Palomares and Delibes, 1991). None the less, these telemetry systems still require a heavy commitment from the researchers that have to track the animal continuously over extended periods of time; and, therefore, it may not provide an accurate time budget of an animal's diel activities. Recently, a storage telemetry system ETHOSYS has been developed to automatically record, for instance, the diurnal rhythms of ungulates based on advanced analysis of sensor-emitted signals (Scheibe et al., 1998; Langbein et al., 1998; Berger et al., 1999). However, this system does not allow the researchers to investigate fine-scale behaviour and is still too heavy to attach to small-sized mammals (<15 kg, Scheibe et al., 1998).

Advances in this domain have come from the recording of data over time, which are stored in the electronic memory of the devices (a.k.a. bio-logging, Boyd et al., 2004). While primarily designed for aquatic species that are hardly accessible to direct observation, the emergence of new technologies, together with the miniaturization of electronic components, has meant that researchers could record a variety of physical and biological parameters over an increasing array of species. Facilitated by recent advances in the data-logger technology, data-loggers that record body movements through acceleration signals have been developed and deployed on a variety of animals, enabling researchers to monitor various activities (e.g. Yoda et al., 1999; Tanaka et al., 2001; Sato et al., 2003). The monitoring of the body movements and posture of an animal by a data-logger that detects the changes in static and dynamic acceleration along two axes has proved especially helpful in determining the time budget activity of free-ranging aquatic animals (Yoda et al., 1999, 2001; Kawabe et al., 2003; Ropert-Coudert et al., 2004).

In the present study, acceleration data-loggers were attached to a captive domestic cat, *Felis catus*, in order to test the potential of this device to characterize efficiently the different behaviours of a terrestrial vertebrate. We also discuss the potential of applying this method to free-ranging cats and other terrestrial mammals.

2. Method

2.1. Data collection

The study was conducted in a house, the adjacent sugar cane fields and secondary forests on Iriomote Island (24°19′N, 123°54′E), Ryukyu Archipelago, Japan, in November 2002.