

RESEARCH ARTICLE

Classifying the activity states of small vertebrates using automated VHF telemetry

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Abstract

1. The most basic behavioural states of animals can be described as active or passive. While high-resolution observations of activity patterns can provide insights into the ecology of animal species, few methods are able to measure the activity of individuals of small taxa in their natural environment. We present a novel approach in which a combination of automatic radiotracking and machine learning is used to distinguish between active and passive behaviour in small vertebrates fitted with lightweight transmitters (<0.4 g).
2. We used a dataset containing >3 million signals from very-high-frequency (VHF) telemetry from two forest-dwelling bat species (*Myotis bechsteinii* [$n = 52$] and *Nyctalus leisleri* [$n = 20$]) to train and test a random forest model in assigning either active or passive behaviour to VHF-tagged individuals. The generalisability of the model was demonstrated by recording and classifying the behaviour of tagged birds and by simulating the effect of different activity levels with the help of humans carrying transmitters. The model successfully classified the activity states of bats as well as those of birds and humans, although the latter were not included in model training (F1 0.96–0.98).
3. We provide an ecological case-study demonstrating the potential of this automated monitoring tool. We used the trained models to compare differences in the daily activity patterns of two bat species. The analysis showed a pronounced bimodal activity distribution of *N. leisleri* over the course of the night while the night-time activity of *M. bechsteinii* was relatively constant. These results show that subtle differences in the timing of species' activity can be distinguished using our method.
4. Our approach can classify VHF-signal patterns into fundamental behavioural states with high precision and is applicable to different terrestrial and flying vertebrates. To encourage the broader use of our radiotracking method, we provide

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Telemetric Studies Of Vertebrates

L. David Mech



Telemetric Studies Of Vertebrates:

Telemetric Studies of Vertebrates Zoological Society of London,1982 Advances in Marine Vertebrate Research in Latin America Marcos R. Rossi-Santos,Charles W. Finkl,2017-08-10 This book gathers the most recent research findings on ecology and conservation of marine vertebrates in Latin America making use of high technological methods to show readers the diversity of the marine research that has been conducted in these countries over the last decades The book brings authors from more than 23 institutions of 7 different countries developing the most diverse research aiming at ocean conservation through the ecology of different vertebrate animals such as whales dolphins manatees turtles seabirds and fish This book deals with technological advances and innovation in the ecology and conservation of marine vertebrates in Latin America This eclectic collection is broad in scope but provides detailed summaries of new methods that are deployed in the study of marine environmental conservation Key issues revolve around the development and application of educational methodologies in the field of marine vertebrate research which provide a rational basis for better management of marine environments using modern techniques associated with GIS satellite tracking aerial systems bioacoustics biogeochemistry genetics underwater videography species photoidentification molecular biology trophic ecological methods ethological methods and behavioural ecology among others Discussion and elucidation of these kinds of techniques are aimed at university level students and post graduate researchers The scope of this volume includes whales sharks rays dolphins tropical fishes turtles manatees as well as aspects of Latin American marine ecosystem conservation Researchers in this biogeographic region as well as others involved with marine vertebrate research will find this work essential reading

Vertebrate Damage Control Research in Agriculture ,1970 **A Manual for Wildlife Radio Tagging** Robert Kenward,2001 Previous ed published as Wildlife radio tagging 1987 **Vertebrate Ecophysiology** Don Bradshaw,2003-04-24 Ecophysiology attempts to clarify the role and importance of physiological processes such as digestion and respiration in the ecological relations of species in their natural habitats The basic principles and methods that are central to any ecophysiological study are outlined and discussed including animal capture blood collection and the measurement of plasma components and hormone levels Attention is paid to animal welfare and ethical considerations and the question of stress and how to identify its presence in animals in their natural environment is approached through a series of case studies Examples are given from a wide range of vertebrates living in deserts cold climates and oceans and recent findings on the physiological adaptations of Antarctic birds and mammals are a highlight of the book This textbook will provide an introduction to the study of ecophysiology for advanced undergraduates and postgraduate students as well as researchers in ecology biodiversity and conservation Handbook of Animal Radio-Tracking L. David Mech,1983

Vertebrate Biology Donald W. Linzey,2020-08-04 The most trusted and best selling textbook on the diverse forms and fascinating lives of vertebrate animals Covering crucial topics from morphology and behavior to ecology and zoogeography

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Marine Research, 1969 Current Catalog
National Library of Medicine (U.S.), 1982 First multi-year cumulation covers six years 1965-70 National Library of Medicine Current Catalog National Library of Medicine (U.S.), 1982

Ecology of High Altitude Waters Dean Jacobsen, Olivier Dangles, 2017 Despite the abundance of high altitude aquatic ecosystems in certain regions, their biology and ecology has never been summarized in detail. Although poorly considered in classical textbooks of ecology and limnology, these threatened and exploited habitats have much to offer existing aquatic ecological theories and applications.

Radio Tracking and Animal Populations Joshua Millspaugh, John M. Marzluff, 2001-08-14 Radio Tracking and Animal Populations is a succinct synthesis of emerging technologies and their applications to the empirical and theoretical problems of population assessment. The book is divided into sections designed to encompass the various aspects of animal ecology that may be evaluated using radiotelemetry technology, experimental design, equipment, and technology, animal movement, resource selection, and demographics. Wildlife biologists at the leading edge of new developments in the technology and its application have joined forces.

Structure and Function of an Alpine Ecosystem William D. Bowman, Timothy R. Seastedt, 2001-04-26 Alpine Tundra **Fishery Bulletin**, 1999 *Proceedings - Vertebrate Pest Conference*, 2018

Advances in Vertebrate Neuroethology Jorg-Peter Ewert, 2012-12-06

This volume presents the proceedings of the NATO Advanced Study Institute on Advances in Vertebrate Neuroethology held at the University of Kassel, Federal Republic of Germany, in August 1981. During the last decade, much progress has been made in understanding the neurophysiological bases of behavior in both vertebrates and invertebrates. The reason for this is that a number of new physiological, anatomical, and histochemical techniques have recently been developed for brain research which can now be combined with ethological methods for the analysis of animal behavior to form a new field of

research known as Neuroethology The term Neuroethology was originally introduced by S L Brown and R W Hunsperger 1963 in connection with studies on the activation of agonistic behaviors by electrical brain stimulation in cats Neuroethology was more closely defined by G Hoyle 1970 in the context of a review on cellular mechanisms underlying behavior of invertebrates Since the 6th annual meeting of the Society for Neuroscience held in Toronto in 1976 Neuroethology has become established as a session topic NOAA Technical Report NMFS ,1984 **General Technical Report RM.** ,1987 **Vertebrate Life** F. Harvey Pough,Christine Marie Janis,John B. Heiser,1999 Widely regarded as the most authoritative and complete text covering the evolution history and adaptations of vertebrates

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