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## Time counts in animal ecology

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## Introduction

Time is of the essence in ecology. Indeed, approaches to understand the mechanisms that underpin ecological systems and predict their trends can greatly benefit from the explicit consideration of time (Franklin 1989; Lindenmayer *et al.* 2012; Taig-Johnston *et al.* 2017). Ecological systems are constantly being affected by environmental drivers characterised by temporal regimes, such as droughts or heatwaves (*e.g.*, Stevens *et al.* 2012; Avgar *et al.* 2013; Bowler *et al.* 2018). As the moments (*e.g.*, mean, variance, skewness) of these environmental drivers continue to change, more extreme, unpredictable environmental events are being recorded globally (IPCC 2021). Deciphering how such extreme environments may be pushing natural systems outside of the conditions under which they evolved, and potentially causing local extinctions (Suhonen *et al.* 2010) or community collapses (Barendregt *et al.* 2022) is an urgent task for ecologists. The rapid loss of species means that ecologists are working against the clock to understand their roles in nature (Wilson 2017) and are considering ways to reverse the on-going pattern of decline. Ultimately, this is one of the most important tasks we can perform, as species loss means the loss of the essential ecosystem functions and services they provide (Diaz *et al.* 2018). Thus, time is of the essence to better understand and forecast the dynamics of ecological systems.

The importance of time in ecology is made ever more tangible in the context of eco-evolutionary dynamics (Shefferson & Salguero-Gomez 2015; Croll, Egas & Smallegange 2019). Fifteen years after the special feature “Evolution on Ecological Time-Scales” (Carroll *et al.* 2007), this burgeoning discipline has shown plenty of examples where evolutionary processes can and do often occur at temporal scales much faster than previously thought (Faillace & Morin 2020). As such, time is also key to examining core aspects such as local adaptation (Hansen *et al.* 2002), speciation (Knudsen *et al.* 2010), or community assembly (Weslien *et al.* 2011). The importance of temporal replication in ecology and evolution is such that one could simply not answer most of

the “100 fundamental ecological questions” identified by Sutherland and colleagues (2013) without explicitly considering time.

Two of the article types published by *Journal of Animal Ecology* are ideally positioned to enable ecologists to examine the importance of time in ecological systems: *Reviews* and *Long-Term Studies*. *Reviews* implicitly rely on time in that they integrate concepts, experiments, and synthetic findings that typically take years –if not decades– of investigation by the research community to acquire. Recent reviews in *Journal of Animal Ecology* include works on energetic-based migratory tactics (Evans & Bearhop 2022), the use of museum collections to quantify insect population trends (Davis, Guralnick & Zipkin 2022), or the responses of mammals to climate change (Paniw *et al.* 2021). Likewise, *Long-Term Studies* explicitly depend on time for the acquisition of data in a particular system, from which a comprehensive narrative that integrates multiple key findings emerges. Recent examples include the detailed integration of demographic, genetic, and conservation efforts over forty years of research in the red-billed chough *Pyrrhocorax pyrrhocorax* (Reid *et al.* 2022), or the examination of the physiology and life history of red squirrels *Tamiasciurus hudsonicus* during 32 years of field research (Dantzer *et al.* 2020). Naturally, these kinds of narratives are only possible via the examination of a system in the long-term.

The impact of time on animal ecological research via *Reviews* and *Long-Term Studies* on the discipline is undeniable: seven out of the top 20 most cited publications in *Journal of Animal Ecology* since 2015 are one of these paper types. At the top of this ranking is the review on computer vision for animal ecology by Weinstein (2018), the first recipient of the prestigious Sidnie Manton award (<https://animalecologyinfocus.com/2018/04/13/congratulations-to-ben-weinstein-on-winning-the-inaugural-sidnie-manton-award/>).

Dr Sidnie Manton (1902-1979), FRS, FLS, was one of the most outstanding zoologists of the 20<sup>th</sup> century. She left a legacy of excellence in research in zoology, marine biology, and conservation biology (Creed 1979). Dr Manton studied Natural Sciences at Girton College, Cambridge, receiving the highest mark, but was not eligible to receive the corresponding University Prize because her of gender. Having received her PhD in Zoology, she became the first woman awarded a Cambridge Sc.D., in 1934. Her *opus magnum* (Manton 1977) summarised 50 years of work on arthropod development and functional morphology. This publication arguably remains the most significant work on arthropods to date (Scharm 2016). The appendixes of this publication alone include ca. 1,200 pages of carefully depicted drawings and detailed descriptions of form and function. Her book successfully synthesised time: not only the 23 years of a fascinating professional career, but also of the millions of years that elapsed for arthropods to evolve to become such a specious and diverse group. Dr Sidnie Manton's long-standing commitment to the understanding of the evolution of arthropod locomotion mechanisms served as inspiration for the eponymous award, the "Sidnie Manton Award", first announced by *Journal of Animal Ecology* in 2018. The purpose of this award is to recognise and celebrate the best *Review* or *Long-Term Study* in animal ecology by an early career researcher (ECR, hereafter).

Writing a *Review* or *Long-Term Study* in animal ecology is an exciting opportunity, particularly for ECRs, who are oftentimes fully caught up with the latest developments in their specific fields of expertise. However, we have heard at conferences and via informal conversations with some ECRs how daunting this task can seem. Thus, our motivation in this editorial is to demystify *Reviews* and *Long-Term Studies* to encourage ECRs to submit abstracts on their prospective works to the open competition for the 2023 Sidnie Manton Award (<https://www.britishecologicalsociety.org/journal-animal-ecology-sidnie-manton-award-entry-form/>). After all, ECRs are arguably best placed to make important contributions to these article types, contrary to an initial perception that time plays against most of them due to their more junior

status. Indeed, it is common in many PhD projects that the supervisor suggests for the student to write a first chapter in the shape of a review, thus allowing them to quickly become acquainted with their fields. Turning that first review chapter into a *Review* is a logical step – and we are always open to hearing from you regarding feasibility of your research in *Journal of Animal Ecology*. But what about *Long-Term Studies*? After all, those really do require long-term data. While that is true, that does not mean that the ECR needs to have collected all of it, but rather led the integration into the paper (e.g., Salguero-Gómez *et al.* 2013). Let us also not forget that our definition of long-term is commensurate to the generation time of the species or the turn-over rate of the system. Indeed, a long-term dataset can be acquired in certain very short-lived species within a few months.

We base our judging of the Sidnie Manton Award on the four different criteria we identified as important for an effective Review or Long-Term Study. As such, our first few tips are meant to strengthen authors' works in each of these criteria. Authors might also benefit from reading Sayer's (2018) piece on how to write an excellent *Review*, whose tips also apply to *Long-Term Studies* to a large extent.

- i. ***A well-balance overview of the topic***: Be familiar with your ecological topic (for *Reviews*) and with the research that has emanated from the study of your system (for *Long-Term Studies*). Powerful *Reviews* and *Long-Term Studies* do not limit themselves to describing and synthesising the research carried out within the authors' group and/or research that uniquely adheres to their school of thought. Are there findings that are at odds against one another, are there schools of thought in your discipline that disagree on philosophies, approaches, or interpretation? If so, talk about them openly. Present all that is known -in a brief manner of course- regarding your chosen topic, even -or especially if- different findings/research groups argue for opposing views. Allow the reader to pass judgement on which one is more likely correct.

- ii. **Novel insights:** Be familiar with the latest developments within your discipline and how those might link with adjacent areas of research and/or similar study systems. By doing so, you will be able to explicitly articulate how novel ideas resulting from integrating topics in your *Review* or *Long-Term Study* represents a leap forward in animal ecology.
- iii. **An advance to the field:** Make sure that your narrative explains explicitly how the research in your area (for *Reviews*) and in your system (for *Long-Term Studies*) helps advance not only your individual professional interests, but also the discipline at large. This criterion can be best tackled by linking your findings to gaps of knowledge in the discipline.
- iv. **Future directions for research:** Successful *Reviews* and *Long-Term Studies* do not only talk about the past and the present but make suggestions for the future. So you have written a compelling, synthetic account of the research that has been performed in your discipline/study system... but what next? Given the emergence of new technologies, frameworks, and statistical approaches (e.g., van de Pol & Brouwer 2021; Dhanjal-Adams, Willener & Liechti 2022; Gupte *et al.* 2022), the confluence of sub-disciplines within ecology and other sciences (e.g., Farine & Whitehead 2015; Fountain-Jones *et al.* 2019), the pressing needs of societal demands (Diaz *et al.* 2018), and the current gaps of knowledge (e.g., Stutchbury 2007; Conde *et al.* 2019; Owen-Smith *et al.* 2020; Paniw *et al.* 2021), where should the discipline go to next (for *Reviews*) and how could those long-term data be used next (for *Long-Term Studies*)?

In structuring a *Review* or a *Long-Term Study*, authors should feel free to deviate from the classic “intro, methods, results, discussion” format of research articles. Instead, we suggest that the structure be determined by the topic and the needs to articulate the authors’ ideas. What is the most puzzling question in the field, original motivation, or controversy? We would suggest that your paper starts with those key points. Throughout the manuscript, a narrative that successfully

intertwines different sections and builds on a historical understanding of the area/study system tends to raise more appeal from our broad readership. In both article types, no novel analyses of data are allowed, though a synthetic analysis of existing findings may be appropriate for *Reviews*. Similarly, due to the richness of views, findings, and data that these article types tend to include, authors may want to provide visual support in the shape of figures that integrate the various bits of knowledge into a diagram or timeline. Finally, both article types should promote reproducibility. This means that, if the *Review* is based on a literature search, the key-word search and review scheme should be explicitly stated, much alike the PRISMA guidelines (Page *et al.* 2021). For *Long-Term Studies*, reproducibility means that the data described in the article should accompany the paper as an open-access resource.

We regularly commission pieces for *Reviews* and *Long-Term Studies* (as well as *Concepts* and *Research Methods Guides*). Authors (particularly ECRs, and from regions and/or ecological systems not well represented) are welcome to contact our commissioning editor (Rob Salguero-Gómez; [rob.salguero@biology.ox.ac.uk](mailto:rob.salguero@biology.ox.ac.uk)) to discuss their ideas and feasibility for the Sidnie Manton Award and our Journal. The Sidnie Manton Award has recognised ECR excellence in research in multiple areas of animal ecology, including computer vision (Weinstein 2018), macroimmunology (Becker *et al.* 2020), and most recently on animal-vectorled spatial ecosystem subsidies (Ellis-Soto *et al.* 2021). If you are currently working in an exciting area not yet represented in the above, and/or in study systems for which long-term data (or shorter-term data on species with short generation time / high turnover) exist, why not pitch us your idea? Or even better, if you are an ECR submit your suggestion as a potential entry for the Sidnie Manton Award to the current open call, closing on the 17<sup>th</sup> of February 2023? (<https://www.britishecologicalsociety.org/journal-animal-ecology-sidnie-manton-award-entry-form/>).

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## CONFLICT OF INTERESTS

The authors have no conflict of interest to declare.

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