Animal Behaviour 239 (2026) 1–4

Contents lists available at ScienceDirect

Animal Behaviour

journal homepage: www.elsevier.com/locate/anbehav

Special Issue: Addressing Biases in Animal Behaviour

# Beyond bias: building a more inclusive and rigorous research culture in animal behaviour

Research in animal behaviour, like all scientific disciplines , is subject to systematic biases, defined as consistent, nonrandom influences that shape the generation, analysis, interpretation and dissemination of scientific knowledge (e.g. medicine: Kadar, 2010; McGauran et al., 2010; Van Aert et al., 2019; psychology: Carter et al., 2019; Francis, 2012; Henrich, 2020; Nielsen et al., 2017; ecology: Baker et al., 2019; Konno et al., 2020; Lortie et al., 2007; Nakagawa et al., 2022). Biases can operate at multiple stages of the research process and often remain implicit, embedded in standard practices, theoretical traditions and practical constraints. When systematic biases are ignored or go unrecognized, they can threaten the robustness, reproducibility and generalizability of scientific findings. In Table 1 we outline different biases in the field of animal behaviour and potential solutions to address them. Importantly, these biases are not sporadic deviations but persistent features of scientific inquiry, progressively shaping research trajectories, standards of evidence and the resulting knowledge systems.

This special issue arose from contributions and discussions at the Association for the Study of Animal Behaviour (ASAB) Winter Meeting 2024 and beyond. The ASAB winter meeting was organized by members of the ASAB Equality Diversity Inclusivity and Accessibility (EDIA) committee, with the aim of bringing together researchers from animal behaviour and related disciplines to critically examine the role of bias in our research as well as ways to address these biases. The meeting highlighted not only shared concerns about how biases emerge and persist, but also an overwhelmingly constructive and solution-focused discussion of practical ways to identify, mitigate and ultimately reduce their impact across different stages of the research process. The contributions assembled in this special issue reflect the breadth of those discussions, translating them into concrete examples, conceptual advances and methodological recommendations aimed at fostering a more reflective and robust science of animal behaviour.

## HISTORICAL BIASES

Historical biases have long shaped the field of animal behaviour, influencing which researchers are visible, which perspectives are valued, and which work is recognized and cited (Lee, 2020; Tang-Martínez, 2020). Gourevitch et al. (2026, in this Special Issue) address biases that arise when broad theoretical frameworks are used to simplify and categorize the remarkable diversity of sexual behaviours observed in nature. The authors critically examine how influential concepts such as anisogamy, the Darwin–Bateman paradigm and the resulting 'Sexual Cascade' have shaped expectations about sex roles and sexual behaviour, sometimes reinforcing overly simplistic or biased assumptions about how females and males should behave. While these frameworks have been valuable for understanding general patterns of sexual selection, the paper argues that they have limited predictive power for specific reproductive behaviours and risk obscuring ecological and life history variation. By emphasizing ecological context and empirical diversity, this work calls for more nuanced, flexible theories that acknowledge sexual complexity rather than constraining it.

Priestley and Wascher (2026, in this Special Issue) critically examine how conceptual biases embedded in the mirror self-recognition paradigm have shaped the study of self-awareness in nonhuman animals. The authors show that anthropocentric framing privileges visual self-recognition and human-like expressions of self-related processing, while overlooking alternative explanations and nonvisual or ecologically relevant forms of self-awareness. Drawing on evidence across 89 studies spanning 62 species, the review highlights how failures in mirror-based tests are frequently interpreted as cognitive absence rather than methodological mismatch. The authors aim to encourage the design of future studies that address these limitations, for example by testing a broader range of species or developing more ecologically relevant testing paradigms.

Patterns of authorship, conference invitations and editorial decisions have traditionally favoured certain demographics, leading to systemic underrepresentation of women and other marginalized groups in both leadership roles and highly cited publications (Cheryan et al., 2024; Nuñez et al., 2026; Ross et al., 2022). Papadopoulou and Afruni (2026, in this Special Issue) investigate the effects of gender ratios in authorships on citation performance from publications in the past 20 years. Despite an overall shift towards more balanced gender representation, they identify the continued prevalence of male-dominated author groups and a very low representation of single female authors. Similarly, Legg and Ostojić (2026, in this Special Issue) assess the geographical representation of authors and species in articles published in *Animal Behaviour*, documenting an overrepresentation of authors affiliated with institutions in Oceania, Europe and North America. Greater gender and geographical diversity within collaborative teams is associated with broader perspectives and increased scientific innovation (Naik et al., 2023; Nepelski et al., 2019; Sunder et al., 2025), underscoring how actively fostering diversity in research collaborations can positively shape the development of the field.

https://doi.org/10.1016/j.anbehav.2026.123671
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**Table 1**
Key biases in animal behaviour research and recommendations for potential solutions to overcome biases

| Bias type | Description and impact | Recommendation | Source |
|---|---|---|---|
| Historical bias | Past preferences and traditions shape current research focus, perpetuating overrepresentation of certain groups of researchers, topics and theoretical assumptions | Promote leadership and visibility of marginalized researchers. Provide mentorship and networking programmes. Ensure inclusive funding and research opportunities | Baker et al. (2019); Lee (2020); Tang-Martínez (2020) |
| Observer/expectation bias | Observers' expectations influence data collection | Employ masked protocols and interobserver reliability | Freeberg et al. (2024) |
| Pseudoreplication | Treating nonindependent data points as independent inflates significance and biases conclusions | Use appropriate statistical models to account for structure | Whitehouse et al. (2024) |
| Statistical and analytical biases | Inappropriate use of statistical tests or ignoring data structure can distort findings | Follow guidelines for statistical design and reporting | Garamszegi (2016) |
| Publication bias | Nonsignificant or negative results are less likely to be published, skewing the literature | Encourage publication of all results, not just positives | Nakagawa et al. (2022) |
| Exaggeration bias | Small sample sizes reduce reliability and inflate effect sizes. Exaggeration of the importance of the relationships aimed to be quantified | Plan for adequate sample sizes and report power analyses | Kimmel et al. (2023) |
| Taxonomic bias | Certain taxa (e.g. vertebrates, birds, mammals) are overrepresented, limiting the generality of findings and skewing theory development | Prioritize research on underrepresented taxa; encourage funding and publication diversity | Rosenthal et al. (2017) |
| Sampling bias | Nonrandom selection of animal subjects leads to unrepresentative samples, limiting generalizability | Use frameworks like STRANGE to assess and report biases | Webster and Rutz (2020) |
| Geographical bias | Research is concentrated in certain regions (e.g. temperate, wealthy countries), neglecting others | Support research in underrepresented regions | Culumber et al. (2019) |

## OBSERVER BIASES

Observer expectations can subtly or substantially influence data collection, even for seemingly objective measures. Pinto (2026, in this Special Issue) reviews studies employing matching-to-sample tasks, which are standardized laboratory paradigms widely used to assess learning ability, where individuals are required to select between two options following the presentation of a stimulus. Although such tasks are often regarded as objective due to their controlled laboratory implementation, Pinto (2026, in this Special Issue) highlights several sources of bias and limitation. These include species-specific differences in sensory perception, motivation and interpretation of task features such as the intertrial interval, which can systematically affect performance independently of learning ability. Crucially, observer expectations regarding task suitability or expected performance may influence how training criteria are set, how ambiguous responses are classified and when trials are terminated or repeated.

To mitigate observer bias, researchers should adopt masked or automated data collection protocols wherever feasible, predefine training and exclusion criteria and report task parameters in sufficient detail to allow critical evaluation and replication (Tuyttens et al., 2014). Incorporating species-specific pilot testing, using multiple complementary tasks and explicitly acknowledging perceptual and motivational assumptions can further reduce bias. Finally, integrating comparative and ecological perspectives into experimental design can help ensure that laboratory-based cognitive tests measure the intended constructs rather than observer-driven expectations or artefacts of task design.

## STATISTICAL AND ANALYTICAL BIASES

A reanalysis of the data set used by a previous study (Pardo et al., 2024) demonstrates how biases arising from data structure and analytical choices can lead to inflated Type I error in animal behaviour research. The original evidence for 'name-like' calls in African savannah elephants, *Loxodonta africana*, was shown to be strongly influenced by pseudoreplication, extreme imbalance in caller–receiver pairs and temporal autocorrelation, which machine-learning models were able to exploit to achieve apparently high classification accuracy (Dharmarajan, 2026, in this Special Issue). When appropriate null models, resampling strategies and statistical approaches controlling for pseudoreplication and temporal dependence were applied, the reported effects disappeared, revealing no support for receiver-specific vocal labels. This case highlights how unrecognized pseudoreplication, particularly in complex, high-dimensional behavioural data sets, can systematically bias inference.

## TAXONOMIC AND SUBJECT SAMPLING BIASES

Taxonomic bias is a persistent challenge in animal behaviour research, arising when a narrow subset of animal groups dominates the empirical literature (Rosenthal et al., 2017). Dochtermann et al. (2026, in this Special Issue) examine the consequences of taxonomic bias for synthesis research by conducting a meta-meta-analysis of meta-analyses published in *Animal Behaviour*, *Behavioral Ecology* and *Behavioral Ecology and Sociobiology* between 2000 and 2024. They show that taxonomic bias in primary studies systematically influences meta-analytic effect size estimates, leading to substantial misestimation and, in some cases, changes in statistical significance. These results highlight taxonomic biases as a major concern, especially when generalizable inferences about specific behaviours are an aim.

Next to taxonomic bias, another pervasive form of sampling bias in animal behaviour research is the systematic focus on a single sex, often males. This focus is driven, for example, by long-standing assumptions from sexual selection theory predicting that singing is predominantly a male trait associated with mate attraction, resulting in the widespread neglect of female song (Barros et al., 2024). Yelimlieş et al. (2025, in this Special Issue) conducted playback experiments to investigate seasonal patterns and functions of female song in Galápagos yellow warblers, *Setophaga petechia aureola*. They show that female song is very common in this resident species and females respond to playbacks by singing and being aggressive, mostly in the nonbreeding season. This case illustrates how historical biases can become embedded in theoretical assumptions, influencing which behaviours are deemed worthy of study and how their functions are interpreted. By overlooking female birdsong, research has likely overemphasized mating-related explanations while underestimating the roles of song in territorial defence, social competition and year-

round social dynamics. Ensuring a systematic focus on both sexes enables more complete evolutionary explanations and facilitates the development of more accurate and generalizable theories of animal communication and behaviour.

Long-term studies of wild animal populations have been central to advances in animal behaviour, providing unparalleled longitudinal insight into individual- and group-level processes (Clutton-Brock & Sheldon, 2010). However, Chakrabarti et al. (2026, in this Special Issue) highlight how intensive research on a small number of well-studied populations can introduce systematic sampling and geographical biases, particularly when findings are generalized as species typical. Focusing on African lions, *Panthera leo*, the authors show that prevailing models of lion social behaviour, largely derived from the Serengeti population, do not adequately capture the ecological and social diversity observed across populations. By demonstrating how research history, methodological conventions and uneven geographical coverage have shaped foundational assumptions, this work underscores the need for comparative, cross-population approaches that treat ecological and epistemic diversity as informative rather than anomalous, thereby broadening the theoretical foundations of animal behaviour research.

The STRANGE framework provides a tool for identifying and mitigating sampling biases related to social background, trappability, rearing history, acclimatization, natural changes in responsiveness, genetic make-up and experience (Webster & Rutz, 2020). Webster et al. (2026, in this Special Issue) provide a combination of real world and hypothetical case studies, to demonstrate how structured reporting of information about subjects and testing procedures can help contextualize mixed findings, enabling both improved assessments of research replicability and deeper biological insight.

## OPPORTUNITIES FOR CHANGE

Addressing systemic biases in animal behaviour research requires more than methodological adjustments; it demands coordinated cultural and structural change across the scientific community. Fostering such change begins with creating an inclusive research culture that values diversity in both people and perspectives, while actively evaluating the needs and experiences of the community. De Moor et al. (2026, in this Special Issue) describe a community-led initiative aimed at addressing financial and structural barriers faced by students and early-career researchers from historically marginalized backgrounds. They report how microgrants and mentorship can foster inclusive participation.

Positive transformation by recognizing and addressing these biases also includes the adoption of frameworks such as STRANGE (Webster & Rutz, 2020) and improved reporting standards. Badihi et al. (2026, in this Special Issue) introduce a new framework, connecting animal welfare, Equity Diversity and Inclusion and environmentally sustainable methods. The Consult, Approve, Research and Evaluate (CARE) framework is designed to enhance scientific integrity, transparency and ethical practice throughout the research process.

## CONCLUSION

Systematic biases are not peripheral concerns in animal behaviour research; they are pervasive features that shape the questions we ask, the systems we study and the conclusions we draw. The contributions to this special issue illustrate how biases arise from multiple sources, conceptual frameworks that oversimplify biological diversity, sampling practices that privilege certain taxa, populations or sexes, analytical approaches that fail to account for data structure, and historical and cultural dynamics that influence visibility and recognition within the field. Left unexamined, these biases risk narrowing our understanding of animal behaviour and potentially reinforce incomplete or misleading generalizations.

At the same time, a unifying message of this special issue is one of optimism and opportunity. Across diverse contexts, authors demonstrate that biases can be identified, quantified and addressed through methodological choices, transparent reporting and inclusive research cultures. Frameworks such as STRANGE and CARE, alongside advances in statistical practice and community-driven initiatives, provide concrete tools for embedding reflexivity, accountability and ethical responsibility throughout the research process. Crucially, addressing bias is not solely the responsibility of individual researchers, but a collective endeavour that involves institutions, funders, publishers and scholarly communities.

By recognizing bias as a structural and dynamic feature of scientific practice rather than an individual failing, this special issue invites the field of animal behaviour to move forward with greater awareness, openness and ambition. Embracing ecological, methodological and epistemic diversity will not only strengthen the reliability of our science but also enrich the questions we ask and the insights we gain into the extraordinary diversity of animal behaviour.

## Author Contributions

**Claudia A.F. Wascher:** Writing – review & editing, Writing – original draft, Conceptualization. **Nicola Koyama:** Writing – review & editing, Writing – original draft, Conceptualization. **Vivek Nityananda:** Writing – review & editing, Writing – original draft, Conceptualization.

## Data Availability

No data were used for this Introduction.

## Declaration of Interest

This special issue was put together by the Guest Editor team under supervision from the journal's Editorial staff, following *Animal Behaviour*'s ethical codes and best-practice guidelines. The Guest Editor team handled the review process. Individual Guest Editors were not involved in assessing papers where they had a personal, professional or financial conflict of interest with the authors or the research described. Independent reviewers assessed all papers.

## Acknowledgments

We are grateful to the Association for the Study of Animal Behaviour (ASAB) for funding the ASAB winter meeting 'Addressing Biases in the Field of Animal Behaviour' (December 2024), which laid the groundwork for this special issue. Thank you to all the contributors to that meeting and to this Special Issue. V.N. has funding from a Leverhulme Trust Research Project Grant (RPG-2021-358) and was supported by a BBSRC David Phillips fellowship (BB/S009760/1).

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Available online 1 August 2026