

Beyond Bias: Building a More Inclusive and Rigorous Research Culture in Animal Behaviour

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Abstract

Systematic biases are pervasive features of scientific practice that shape the questions asked, the systems studied, and the conclusions drawn. In animal behaviour research, such biases can operate across all stages of the research process, from the selection of research topics and conceptual framing through study design, data analysis, interpretation, and dissemination, often remaining implicit within established theories, methodological conventions, and historical traditions. This special issue brings together contributions arising from discussions at the Association for the Study of Animal Behaviour (ASAB) Winter Meeting 2024, with the shared aim of critically examining how biases affect research in our field, and can be addressed.

The papers in this special issue discuss a wide range of biases, including conceptual biases that oversimplify behavioural diversity, taxonomic, geographic, and sex-based sampling biases that limit generalisability, observer and confirmation biases that influence data collection, and analytical biases that distort inference. Several contributions demonstrate how such biases can systematically mislead synthesis research and theory development, while others highlight the role of historical and cultural biases in shaping visibility, authorship, and recognition within the discipline. Importantly, the issue moves beyond diagnosis to solutions, showcasing practical frameworks, methodological innovations, reanalyses, and community-led initiatives designed to improve transparency, inclusivity, and robustness.

Collectively, this special issue emphasises that recognising bias should not be framed as an individual shortcoming, but as a critical foundation for structural and field-level transformation. By embracing ecological, methodological, and epistemic diversity, and by adopting tools such as structured reporting frameworks, improved statistical practices, and inclusive research cultures, animal behaviour research can strengthen its evidentiary foundations and expand its theoretical scope.

Keywords: animal behaviour, biases, historical bias, observer bias, STRANGE, taxonomic bias

Introduction: The Pervasiveness of Bias

Research in animal behaviour, like all scientific disciplines, is subject to systematic biases, defined as consistent, non-random 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), and 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 unrecognised, they can threaten the robustness, reproducibility, and generalisability 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 organised by members of the ASAB Equality Diversity Inclusivity and Accessibility (EDIA) committee, with the aim to bring 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 recognised and cited (Lee, 2020; Tang-Martínez, 2020a).Gourevitch et al., (in press) address biases that arise when broad theoretical frameworks are used to simplify and categorise 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 emphasising ecological context and empirical diversity, this work calls for more nuanced, flexible theories that acknowledge sexual complexity rather than constraining it.

Priestley & Wascher, (2026) critically examine how conceptual biases embedded in the mirror self-recognition paradigm have shaped the study of self-awareness in non-human animals. The authors show that anthropocentric framing privileges visual self-recognition and human-like expressions of self-related processing, while overlooking alternative explanations and non-visual 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 & Afruni, (in press) 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 female single authors. Similarly, Legg & Ostojić, (in press) 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.

Observer Biases

Observer expectations can subtly or substantially influence data collection, even for seemingly objective measures. Pinto, (2026) reviews studies employing matching-to-sample tasks, which are standardised 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) highlights several sources of bias and limitation. These include species-specific differences in sensory perception, motivation, and interpretation of task features such as the inter-trial 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 (Tuytens 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 dataset 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, in press). 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 unrecognised pseudoreplication, particularly in complex, high-dimensional behavioural datasets, 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 dominate the empirical literature (Rosenthal et al., 2017). (Dochtermann et al., 2025) 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 mis-estimation 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) 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 the year-round resident Galápagos yellow warblers and females responded to playbacks by singing and being aggressive, mostly in the non-breeding 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 overemphasised 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 generalisable 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., (in press) highlight how intensive research on a small number of well-studied populations can introduce

systematic sampling and geographic biases, particularly when findings are generalised as species-typical. Focusing on African lions, 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 geographic 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, acclimatisation, natural changes in responsiveness, genetic make-up and experience (Webster & Rutz, 2020). In the current special issue, Webster et al., (in press) provide a combination of real world and hypothetical case studies, to demonstrate how structured reporting of information about subjects and testing procedures can help contextualise 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., (in press) report on a community-led initiative aimed at addressing financial and structural barriers faced by students and early-career researchers from historically marginalized backgrounds. The report how microgrants and mentorship can foster inclusive participation.

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

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240 **Conclusion**

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

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

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

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 422 *and territory defence across seasons in female Galápagos Yellow Warblers*
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 425

426 Table 1: Key biases in animal behaviour research and recommendations for potential
 427 solutions to overcome biases

Bias Type	Description & Impact	Recommendation	References
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 programs. Ensure inclusive funding and research opportunities.	(Baker et al., 2019; Lee, 2020; Tang-Martínez, 2020b)
Observer/Expectation Bias	Observers' expectations influence data collection.	Employ masked protocols and inter-observer reliability.	(Freeberg et al., 2024)
Pseudoreplication	Treating non-independent 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	Non-significant 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	Non-random selection of animal subjects leads to unrepresentative samples, limiting generalizability.	Use frameworks like STRANGE to assess and report biases.	(Webster & Rutz, 2020)

Geographic Bias	Research is concentrated in certain regions (e.g., temperate, wealthy countries), neglecting others.	Support research in underrepresented regions.	(Culumber et al., 2019)
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