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SPECIAL ISSUE: DOGS AND CONSERVATION: CURRENT AND EMERGING CONSIDERATIONS

Dogs and Conservation: emerging themes and considerations

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The domestic dog (*Canis lupus familiaris*) has assisted people with a multitude of practical tasks for millennia (Parker et al. 2017). Alongside the > 470 million dogs considered family members (Bedford 2020), many others are actively employed in applications including agriculture, combat and law enforcement, medical detection and therapy provision. Dogs are also increasingly used to help conservation partners tackle poaching and the illegal trade in flora and fauna, gather ecological data about imperilled and invasive species and/or their habitats, detect illegally used poisons and their animal victims, and as alternatives to lethal control of wildlife. However, their use in fragile or disturbed environments and ecosystems may unintentionally have detrimental consequences. For example, dog faeces may introduce (sometimes non-native) parasites or pathogens, and behavioural changes may arise in free-living wildlife as a result of dog presence. Potential direct consequences via wildlife mortality have even been highlighted for separate discussion at the IUCN HWI working group meeting of the International Congress of Conservation Biology (Owens et al. 2019). To more fully examine the implications of using dogs in conservation efforts, we invited manuscripts for a special issue (SI) of *Journal of Vertebrate Biology* from researchers and professionals working with dogs in conservation capacities to explore the following themes: a) evidence of efficacy, or lack thereof, when using dogs in these roles; b) advances in our understanding of related canine biological adaptations, c) novel insights into the behavioural and welfare considerations; d) emerging or re-evaluated sustainability considerations; or e) novel or developing conflicts of interest.

The SI features 14 papers from seven countries in Africa and Europe and one review paper with global coverage (Smith et al. 2020). Many focused on dog efficacy but included novel insights, sustainability considerations and/or dog behavioural factors. A couple focused on biological or breed adaptations and suitability (Horgan et al. 2020, van der Weyde et al. 2020) whilst another two evaluated concerns or undesirable issues arising from the use of dogs in conservation (Drouilly et al. 2020, Smith et al. 2020). We are pleased to include articles from working professionals reporting on the practical, logistical and biological aspects of using dogs in conservation, alongside those from specialist academic researchers recounting the use of dogs as independent observers. We were also delighted to receive articles exploring some of the less well reported uses of detection dogs, such as their role in carcass detection (Deák et al. 2020a, b). Although themes related to the human dimensions of dogs in conservation, e.g. handler-dog interactions and relationships (Fig. 1), were not a focus of any submission, several articles incorporated such consideration (e.g. Batlin 2020, Drouilly et al. 2020, Marker et al. 2020). Further research remains

Fig. 1. Dog-handler teams often work in a range of challenging environments and the relationship between the two is critical to their success (photo credit: Working Dogs for Conservation).

warranted in this area, alongside greater recognition of the handler's prominent role and importance within a team pairing, or that of people tasked with overseeing dogs in a working capacity for conservation purposes. Likewise, while the welfare of the dogs themselves was often only discussed as a secondary consideration in the studies/reports submitted, it has direct bearing on sustainability and even viability of a program or method.

The need for sustained capacity and input (e.g. refresher and follow-up training) for those working directly on the ground with working dogs was reflected in a number of papers. In alignment with further prioritizing dog welfare, it would appear prudent to establish authorities to oversee the care, training and use of working dogs in conservation. This development would likely see the resolution of at least a few of the issues of concern raised in this issue (Drouilly et al. 2020, Landry et al. 2020, Marker et al. 2020, Smith et al. 2020), and in previously published articles (Allen et al. 2019, Whitehouse-Tedd et al. 2020). Further, holistic risk assessment may be preferable to attempting to compare risk specifically posed to wildlife by dogs, for example as compared to other lethal alternatives such as poisoning, trapping or shooting. The industry-wide utilisation of a robust monitoring and training programme for dog owners and handlers would facilitate the collection of such all-inclusive datasets, thereby enabling evidence-based and strategic refinement of operational procedures.

In this SI, we sought to promote knowledge transfer and encourage two-way flow of information between academics and more hands-on, in-field, practitioners. As such, submissions were not required to be rooted in "hard" science or statistical analysis, with sharing of observations, anecdotal evidence and practitioner experience also welcomed. Notably, use of language associated with statistical programmes like R; a popular tool in modern ecology studies (Lai et al. 2019), was at times problematic for authors and reviewers, revealing a challenge for research interpretation by practitioners without academic backgrounds or support. Conversely, reports from field practitioners often comprised single -dog or -programme case studies, which might normally have come under academic critique for their limited sample size or lack of statistical analysis. In this regard, we wish to convey our utmost gratitude to the reviewers who gave generously of their time to appraise the submissions and offer expertise, insightful follow-up questions to make the work

more accessible to readers, and guidance – all in the most collaborative of ways.

Overall, there is growing evidence that dogs can be used to significantly benefit conservation, when deployed with sustained support and monitoring. Understanding the strengths and limitations of using dogs for the application in question is key to its success and sustainability. For example, dog-handler teams can increase the probability of finding samples if present and, in tandem, to augment the number of high-quality samples collected for the desired analyses (Deák et al. 2020a, Roda et al. 2020, Sentilles et al. 2020). Their detection sensitivity for the scent of live animals has also been proven (Matthew & Relton 2020, Matthew et al. 2020) and field trials have demonstrated the additional detection capacity provided by detection dogs in surveying wildlife populations (Bearman-Brown et al. 2020). However, the erroneous belief that every single scat, sample or animal present can be found is pragmatically discussed by our contributors and backed with reliable findings. Finally, the potential to introduce unintended and harmful consequences through various applications of dogs must be fully examined before and throughout their use (e.g. Drouilly et al. 2020, Horgan et al. 2020, Marker et al. 2020, van der Weyde et al. 2020). By continually monitoring dog and handler performance, and implementing a regular, objective and reflective review process, dog programmes can be refined and negative impacts minimised or mitigated. This approach is essential in order that, on balance, dogs enlisted to work in service of conservation deliver a truly beneficial outcome.

We thank all who submitted papers to this SI and extend our appreciation to their teammates on the ground, and indeed to all those who are so evidently dedicated to advancing this exciting field and our understanding of it.

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