



Ensuring tests of conservation interventions build on existing literature

That scientific knowledge grows by building on previous understanding is familiarly expressed in English by Isaac Newton's phrasing of a much older idea, "If I have seen further it is by standing on the shoulders of giants." However, in science, we often do not always clamber as high as we could because we fail to consider previous work. Multiple factors beyond quality and relevance affect the likelihood of a scientific article being cited, including the author's status, country, and affiliation (Leimu & Koricheva 2005), number of authors (Neiminen et al. 2007; Sala & Brooks 2008), journal prestige (Tahamtan et al. 2016), length (Neiminen et al. 2007; Stanek 2008), language (van Leeuwen et al. 2001), geographical location of authors and readers (Nunez et al. 2019), direction and strength of the results (Neiminen et al. 2007), accessibility, and whether the article is a self-citation (Schreiber 2009). Furthermore, cited articles are not always used correctly. In ecology (Todd et al. 2007) and marine biology (Todd et al. 2010), 16–18% of citations offer either ambiguous or no support for an associated assertion. Even when articles are debunked, the original papers continue to be cited 17 times more than the rebuttal (Banobi et al. 2011).

We suggest that such failings distort knowledge. Few conservation practitioners cite original studies (Pullin et al. 2004; Sutherland 2004), although there is some evidence this is starting to change (Wainwright et al. 2018). Furthermore, most conservation scientists use previous literature selectively, leading to bias (Gossa et al. 2015). We checked the most recent issue of 5 major conservation journals and found 23 papers testing conservation interventions. Together, authors of these papers failed to cite at least 51 other studies, collected on www.conservationevidence.com that tested the same interventions in similar environments. Such underutilization exaggerates the originality of new findings and distorts impressions of existing knowledge and may result in actions being biased toward the single latest study.

Poor citation practices have distorted ideas (Smith & Banks 2017), such as that Darwin developed his theory of evolution by looking at Galapagos finches, despite not mentioning them in *The Origin of Species* (Sulloway 1983); that exotic ants in Madeira were responsible for the extinction of native ants, which never actually went

extinct (Wetterer 2006); and that black rats were important predators of Australian mammals, based on a study that found no significant effect of rats on native mammal numbers (Smith & Banks 2017). The failure to assess the existing evidence base fully can lead to an overemphasis on outlying, well publicized, or even discredited studies or those published in prestigious outlets. Effective policy and management rarely emerge from single, definitive experiments. Rather, reliable knowledge accumulates from diverse sources of evaluated evidence that persuade communities of professionals (Collins & Pinch 2012; Roche et al. 2019).

We can best understand how to employ interventions by evaluating how they have worked in a range of circumstances. For example, an article on the efficacy of streamer lines in reducing bycatch of seabirds should incorporate previous studies of streamer lines in different locations, with different species, and with different numbers of lines or types of line so as to provide a comprehensive picture of whether the action is generally effective or more effective in some situations than others. In this way, the giant is assembled, and future researchers can avoid pitfalls and target knowledge gaps. Reliability is important and conservation science should encourage studies that replicate interventions (Baker 2016).

One solution is the Conservation Evidence website (www.conservationevidence.com) (Sutherland et al. 2019), which was developed to collect, curate, and summarize tests of conservation interventions. It provides a means of checking the literature. Authors may summarize the existing literature by referring to the individual papers or, if the literature is extensive, make use of the review provided. We envisage a simple, routine check of Conservation Evidence and then addition of other relevant literature. Researchers can use it to check they have not missed key references and may reference the webpage to avoid adding references to their manuscript. Conservation Evidence focuses exclusively on conservation solutions, and does not, for example, collect papers describing threats or compile or summarize conceptual and theoretical papers for hypothesis generation and inference. It does not yet cover interventions for all habitats and taxa, and there may be relevant papers published

since a literature was synthesized by Conservation Evidence.




Other options for extracting the relevant literature include systematic reviews (especially those collated by the Collaboration for Environmental Evidence [www.environmentalevidence.org]); other specialist websites, such as the Resource database of the Society for Ecological Restoration (<https://www.ser-rrc.org/resource-database>) or the CABI Invasive species compendium (<https://www.cabi.org/isc>); standard literature searches (ideally with the search process specified); and the forthcoming Applied Ecology Resources (<https://www.britishecologicalsociety.org/publications/applied-ecology-resources/>), which will host a searchable and citable repository of gray literature.



Forty conservation-focused journals, whose lead editors are authors on this editorial (journal names are italicized in the list of author affiliations), are requesting that authors outline how they have placed the literature in context (e.g., by searching Conservation Evidence) by incorporating this in the submission process or in instructions to authors.

Asking authors who have tested interventions to explain how they have placed their paper in context will help ensure conservation science reduces the perils of cherry picking scientific evidence and will improve the design of future work. It will not provide a complete remedy to bias in conservation articles. Ideally, the impact of this measure will grow as the evidence base grows, so that we can have the extended vision that comes from standing on the shoulders of giants rather than the limited vision from standing on their toes.

Acknowledgments

We thank Arcadia for funding and the referees for improving this piece.

William J. Sutherland ¹,
Sergio Ticol Alvarez-Castañeda,² **Tatsuya Amano**,³
Roberto Ambrosini,⁴ **Philip Atkinson**,⁵
John M. Baxter,⁶ **Alexander L. Bond** ⁷,
Philip J. Boon,⁸ **Katherine L. Buchanan**,⁹
Jos Barlow,¹⁰ **Giuseppe Bogliani**,¹¹ **Olivia M. Bragg**,¹²
Mark Burgman,¹³ **Marc W. Cadotte**,¹⁴
Michael Calver,¹⁵ **Steven J. Cooke**,¹⁶
Richard T. Corlett,¹⁷ **Vincent Devictor**,¹⁸
John G. Ewen,¹⁹ **Martin Fisher**,²⁰ **Guy Freeman**,²¹
Edward Game,²² **Brendan J. Godley**,²³
Christian Gortázar,²⁴ **Ian R. Hartley**,²⁵
David L. Hawksworth,²⁶ **Keith A. Hobson**,²⁷
Ming-Lun Lu,²⁸ **Berta Martín-López**,²⁹ **Keping Ma** ³⁰,
Antonio Machado,³¹ **Dirk Maes**,³²
Marco Mangiacotti,³³ **Dominic J. McCafferty**,³⁴
Victoria Melfi,³⁵ **Sanjay Molur**,³⁶ **Allen J. Moore**,³⁷

Stephen D. Murphy,³⁸ **Darren Norris**,³⁹
Alexander P.E. van Oudenhoven ⁴⁰,
Jennifer Powers,⁴¹ **Eileen C. Rees**,⁴²
Mark W. Schwartz ⁴³, **Ilse Storch**,⁴⁴
and Claire Wordley⁴⁵

¹ Conservation Evidence, Conservation Science Group, Department of Zoology, University of Cambridge, David Attenborough Building, Cambridge CB2 3QZ, U.K.

²Therya, Sergio Ticol Alvarez-Castañeda, Centro de Investigaciones Biológicas del Noroeste, La Paz, BCS 23096, Mexico

³School of Biological Sciences, The University of Queensland, Brisbane, Queensland, 4072, Australia

⁴Avocetta - Journal of Ornithology, and Department of Environmental Science and Policy, University of Milan, Via Celoria 26, Milan, I-20133, Italy

⁵Bird Conservation International, British Trust for Ornithology, The Nunnery, Thetford, Norfolk IP24 2PU, U.K.

⁶Aquatic Conservation, School of Biology, Scottish Oceans Institute, East Sands, University of St Andrews, St Andrews, Fife KY16 8LB, Scotland

⁷Avian Conservation and Ecology, Natural History Museum at Tring, The Walter Rothschild Building, Akeman St, Tring HP23 6AP, U.K.

⁸Aquatic Conservation: Marine and Freshwater Ecosystems, The Freshwater Biological Association, The Ferry Landing, Far Sawrey, Ambleside, Cumbria LA22 0LP, U.K.

⁹Emu - Austral Ornithology, Kate Buchanan School of Life & Environmental Sciences, Faculty of Science, Engineering & Built Environment, Deakin University, Geelong, VIC 3220, Australia

¹⁰Journal of Applied Ecology, Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, U.K.

¹¹Rivista italiana di Ornitologia-Research in Ornithology, Department of Earth and Environmental Sciences. University of Pavia, Via Adolfo Ferrata 9, Pavia, 27100 Italy

¹²Mires and Peat, Geography, University of Dundee, Dundee DD1 4HN, U.K.

¹³Conservation Biology, Centre for Environmental Policy, Imperial College, London Weeks Building, 16-18 Princes Gardens, London SW7 1NE, U.K.

¹⁴Ecological Solutions and Evidence, University of Toronto Scarborough, Toronto, ON, M1C 1A4, Canada

¹⁵Pacific Conservation Biology, Environmental and Conservation Sciences, Murdoch University, Murdoch, WA 6150, Australia

¹⁶Conservation Physiology, Department of Biology and Institute of Environmental and Interdisciplinary Science, Carleton University, Ottawa, ON K1S 5B6, Canada

¹⁷Global Ecology and Conservation, Center for Integrative Conservation, Xishuangbanna Tropical Botanical Garden, Chinese Academy of Sciences, Menglun, Mengla, Yunnan Kunming, 666303, China

¹⁸Biological Conservation, ISEM, Univ Montpellier, CNRS, EPHE, IRD, Montpellier, France

¹⁹Animal Conservation, Institute of Zoology, Zoological Society of London, Regents Park, London NW1 4RY, U.K.

²⁰Oryx, Fauna & Flora International, The David Attenborough Building, Pembroke Street, Cambridge CB2 3QZ, U.K.

²¹Conservation Land Management, NHBS Ltd, 1-6 The Stables, Ford Road, Totnes, Devon TQ9 5LE, U.K.

²²Conservation Letters, The Nature Conservancy, Brisbane, Australia

²³Endangered Species Research, Centre for Ecology and Conservation University of Exeter, Penryn Campus, Cornwall TR10 9FE, U.K.

²⁴European Journal of Wildlife Research, Ronda de Toledo 12, Ciudad Real, 13005 Spain

²⁵Bird Study, Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, U.K.

²⁶Biodiversity and Conservation, Comparative Plant and Fungal Biology, Royal Botanic Gardens, Kew, Surrey TW9 3DS, U.K.

²⁷Avian Conservation and Ecology, Dept. Biology and Environment and Climate Change Canada, University of Western Ontario, Room 2025 BGS Building, 1151 Richmond St. N., London, Ontario N6A 5B7, Canada

²⁸Taiwan Journal of Biodiversity, Division of Management, Taiwan Endemic Species Research Institute, Nantou

²⁹Ecosystems and People, Faculty of Sustainability, Leuphana University of Lüneburg, Lüneburg, 21335 Germany

³⁰Biodiversity Science, 20 Nanxincun, Xiangshan, Haidian District, Beijing, 100093

³¹Journal for Nature Conservation, Chopin 1, 38208 La Laguna, Tenerife, Canary Islands, Spain

³²Journal of Insect Conservation, Species Diversity Group, Research Institute for Nature and Forest (INBO), Brussels, Belgium

³³Acta Herpetologica, Department of Earth and Environmental Sciences, University of Pavia, Via Taramelli 24, Pavia 27100, Italy

³⁴IBIS, International Journal of Avian Science, British Ornithologists' Union, P.O. Box 417, Peterborough PE7 3FX, U.K.

³⁵Journal of Zoo and Aquarium Research, Hartpury University, Gloucester GL19 3BE, U.K.

³⁶Journal of Threatened Taxa, 12 Thiruvannamalai Nagar, Kalapatti-Saravanampatti Road, Saravanampatti, Coimbatore, Tamil Nadu 641035, India

³⁷Ecology and Evolution, College of Agricultural and Environmental Sciences, The University of Georgia, 109 Conner Hall, Georgia, U.S.A.

³⁸Restoration Ecology, School of Environment, Resources & Sustainability, University of Waterloo, Waterloo, ON, Canada

³⁹Tropical Conservation Science, School of Environmental Sciences, Federal University of Amapá, Macapá, AP 68903-419, Brazil

⁴⁰Ecosystems and People, Institute of Environmental Sciences CML, Leiden University, Einsteinweg 2, Leiden, 2333 CC, The Netherlands

⁴¹Biotropica, College of Biological Sciences, University of Minnesota, 1987 Upper Buford Circle, St. Paul, MN 55108, U.S.A.

⁴²Wildfowl, WWT Martin Mere Wetland Centre, Fish Lane, Burscough, Lancashire L40 0TA, U.K.

⁴³Conservation Science and Practice, Department of Environmental Science and Policy, University of California, Davis, CA 95616, U.S.A.

⁴⁴Wildlife Biology, Faculty of Environment and Natural Resources, University of Freiburg, Freiburg, D-79085 Germany

⁴⁵Conservation Science Group, Department of Zoology, University of Cambridge, David Attenborough Building, Cambridge CB2 3QZ, U.K.

Article Impact Statement: Authors of conservation articles asked to include citations of existing evidence and to place studies in context of that evidence.

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