Trends, biases and effectiveness in reported conservation interventions

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SUMMARY

The journal *Conservation Evidence* was launched just over ten years ago and here we review the trends and biases in the studies published between 2004 and March 2014; 246 papers describing 439 conservation interventions in 35 countries. The aim of the journal is to provide a format for practitioners to publish the results of their work. This seems to have been achieved as over 70% of the 609 authors were practitioners. As well as publishing the results of successful interventions, the journal encourages authors to report interventions that were unsuccessful and this was the case for almost a third (31%) of all those published. These results provide especially valuable information to practitioners. Studies published in the first few years tended to be carried out in the UK, but this bias has reduced over time, with at least 60% of papers from overseas in recent years. There continues to be a high rate of male authorship, which is likely to be a symptom of wider scale gender imbalances in conservation amongst both academics and practitioners. The majority of papers submitted to and published in *Conservation Evidence* have focussed on plants and birds (59%). There is a clear need for more studies testing interventions for fish, reptiles, amphibians and fungi. Similarly, few studies so far have focused on the social aspects of conservation.

INTRODUCTION

It is recognised that there is a serious communication gap in conservation between research and practice (Finch & Patton-Mallory 1993), with conservation practitioners partly perceiving academic research as inaccessible, irrelevant and time-consuming (Fazey *et al.* 2005; Sutherland *et al.* 2004; Pullin *et al.* 2004). As a result, conservation practitioners frequently make decisions based on personal experience and anecdotal evidence, much of which is neither evaluated nor recorded, except in the minds of individual practitioners. The journal *Conservation Evidence* aims to provide a forum for conservation practitioners to share the outcomes and impacts of the conservation interventions they carry out. This enables other practitioners to learn about, replicate and improve upon successful interventions. From the interventions that are less successful, practitioners can identify those that should be avoided. Alternatively, by providing full details, practitioners may decide their situation is different, so a previously unsuccessful approach may be worth trying, or may be successful if they modify the approach used.

Conservation Evidence was designed to ensure that the lessons of conservation practice are easily accessible to everyone. Fuller *et al.* (2014) recently found that less than 4% of 19,207 papers in 20 major conservation journals were open access. *Conservation Evidence* was one of the first open-access journals (*PLOS Biology* started a few months before) and ranks top for accessibility of articles published by the 20 journals (Fuller *et al.* 2014). For publishing authors it is also relatively straightforward, fast and free.

Previous studies have shown biases in conservation research papers towards certain taxa and countries (Clark & May 2002, Fazey *et al.* 2005). Amano and Sutherland (2013) similarly showed that the content of conservation databases are biased towards countries with high GDP, those with a high proportion of English speakers and those near to the location of the database.

This review looks back at the publications in *Conservation Evidence* over the ten years since its inception in 2004. Between 2004 and March 2014, *Conservation Evidence* published 264 papers, documenting 439 different conservation interventions. A total of 609 authors, both practitioners and academics, from 31 countries contributed to these papers documenting interventions carried out in 35 countries. Here we review the type of interventions undertaken, the groups of species targeted, where studies occurred and whether or not interventions were successful. We also report the profile of the authors and explore how this has changed over time. This review indicates which areas have received the most attention and, more importantly, those for which there are limited studies and therefore greatest future need.

Which conservation interventions were reported?

To systematically record the types of conservation work that has been published, interventions were categorised by the International Union for the Conservation of Nature action categories (www.iucnredlist.org/technical-documents/classification-schemes), as shown in Figure 1. The overall action category for each paper was recorded, as was the action category for each intervention within a paper as some studies reported on more than one. Figure 1 shows that the most common interventions reported were invasive/problematic species control and site/area management, which includes actions such as cutting, grazing or burning vegetation. Species recovery, which includes interventions such as providing nest sites and translocations, were also frequently reported. Few papers focused on the social sciences aspect of conservation (Figure 1). The 2013 volume included a special issue focussed on human behaviour change, which contained 44% of all interventions aimed at education and awareness ever published in the journal.

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ISSN 1758-2067

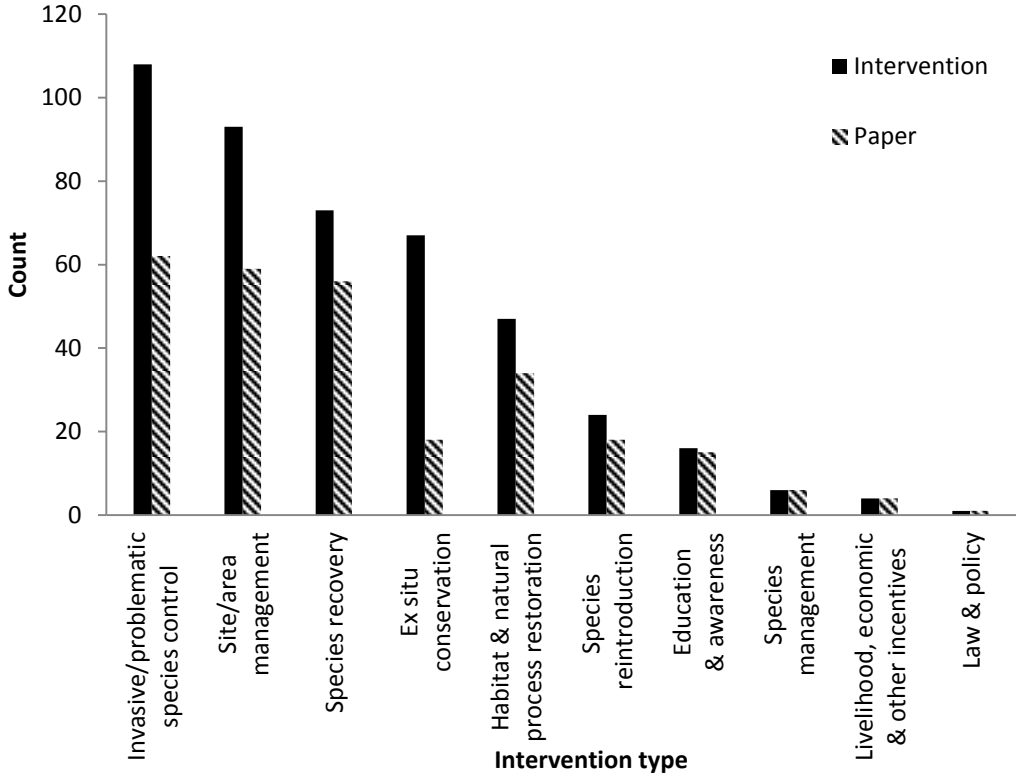

Figure 1. Total number of times each conservation intervention type was carried out. Both the general intervention category for each paper and the specific interventions within each paper were recorded.

Which taxa were studied?

Previous reviews examining biases in studies in conservation journals have often shown a disproportionate number examining mammals and birds (Clark & May 2002, Báldi & Collin 2003, Fazey *et al.* 2005), with fewer covering amphibians, reptiles, plants, fish or invertebrates. As shown in Figure 2, this bias is less marked in *Conservation Evidence*, with plants making up the largest proportion of publications (30%) and invertebrates comprising 12%. Birds were well represented as expected, but mammals less so. As found in other reviews, studies focussing on amphibians, fish and fungi were limited. Fish and fungi were similarly found to be underrepresented by Fazey *et al.* (2005), who reviewed three prominent conservation journals. The same study found that only 4% of publications focussed on introduced species, despite these being considered one of the greatest drivers of biodiversity loss by the Millennium Ecosystem Assessment (2005). In *Conservation Evidence*, 12% of studies focussed on introduced species, predominantly testing eradication techniques.

Who published in *Conservation Evidence*?

Conservation Evidence has had 609 contributing authors within the timespan of this review. One of the journal's key aims is to provide a publishing opportunity for conservation practitioners and so it was expected that these would form the

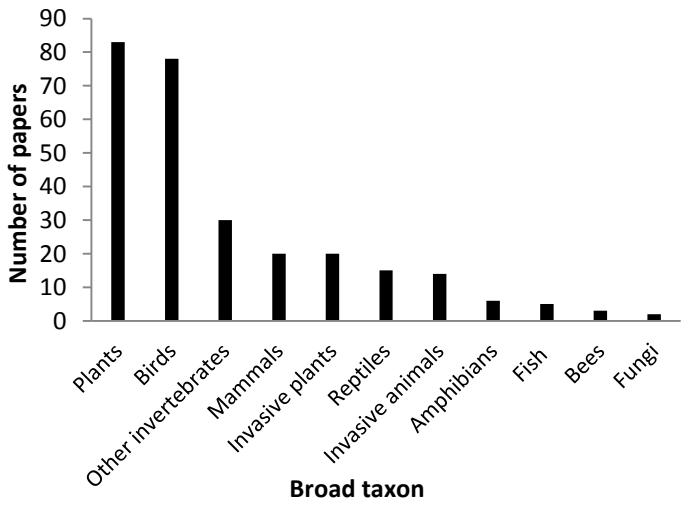

Figure 2. Number of papers that focus on each of the broad taxonomic groups.

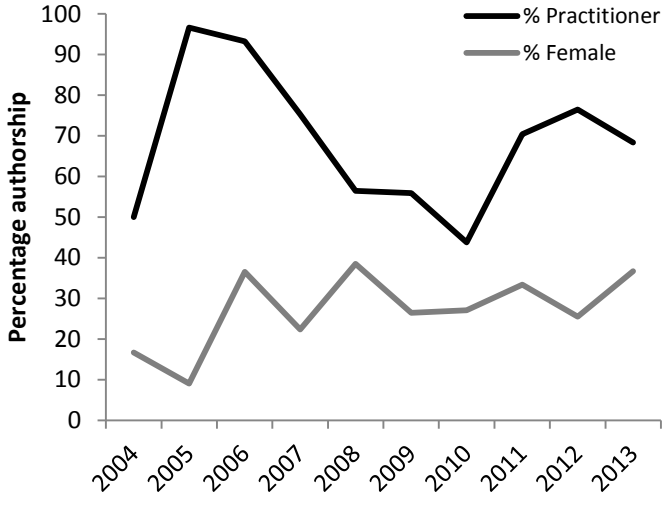

Figure 3. Change in the percentage of practitioners and female authors over time.

ISSN 1758-2067

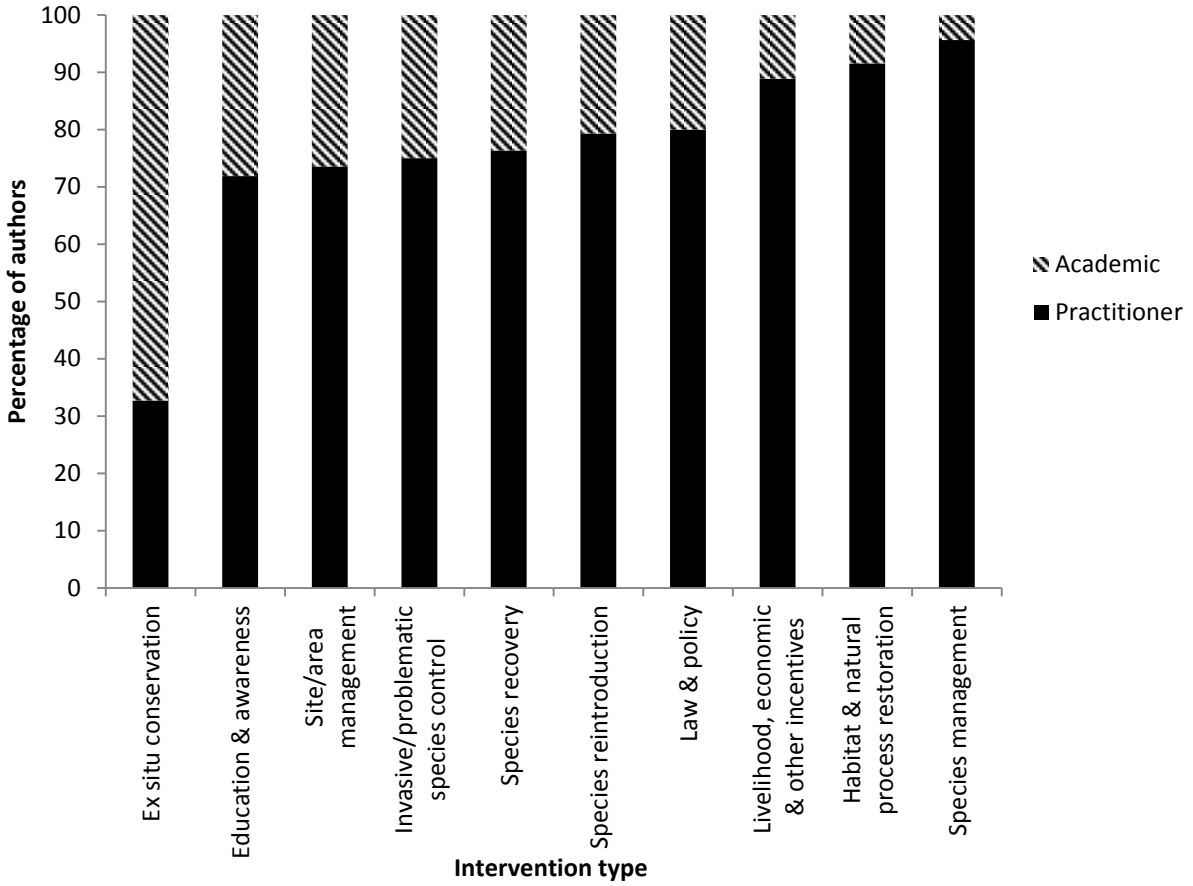

Figure 4. Proportion of academic and practitioner authors for different interventions.

majority of the authors. The authors were assigned as either academic or practitioner based on their institutional affiliation (those from academic institutions were counted as academics and all others were counted as practitioners). Within conservation those working within academic institutions often research conservation techniques but may have limited experience in implementing interventions. In contrast, practitioners are more involved with 'hands-on' conservation interventions, but are less likely to have the resources available to conduct large scale research. As previously mentioned there is often a disconnect between the two groups, within *Conservation Evidence* only 22% of papers had at least one member of each group as an author, highlighting the lack of collaboration between these two groups. Conservation practitioners made up the majority of authors (72%) and first authors (70%), suggesting that *Conservation Evidence* has achieved its aim of providing a journal written by conservation practitioners for conservation practitioners. The proportion of practitioner authors has varied considerably across the years (44-97%; Figure 3).

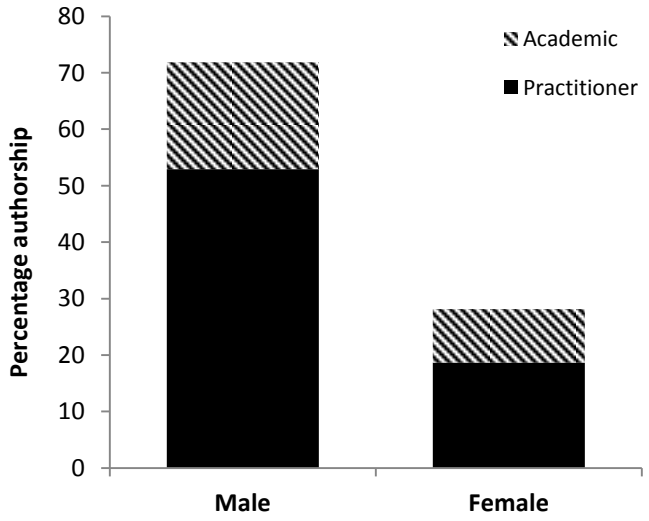

Figure 5. Author profile in terms of type of institutional affiliation and gender.

Figure 4 shows the type of conservation interventions published in *Conservation Evidence* with the corresponding percentage of practitioner authorship of these papers. Most of the interventions had high levels of practitioner authorship (68-96%), as hoped. The exception was *ex situ* conservation, for which only 33% of the authors were affiliated with practical conservation institutions. This is perhaps due to the requirement of specialised equipment and laboratories often required for this kind of intervention, which is more likely to be available within universities and research institutes.

Gender was another aspect of authorship profile that was considered. Overall, 28% of all contributing authors were female, with female first authorship at 25%. Figure 3 shows an increasing trend in female authorship, although this is yet to surpass 40% in any year. Figure 5 shows the author profile categories, with male practitioners being the predominant group, male academics and female practitioners being represented fairly equally and female academics as the least well represented group.

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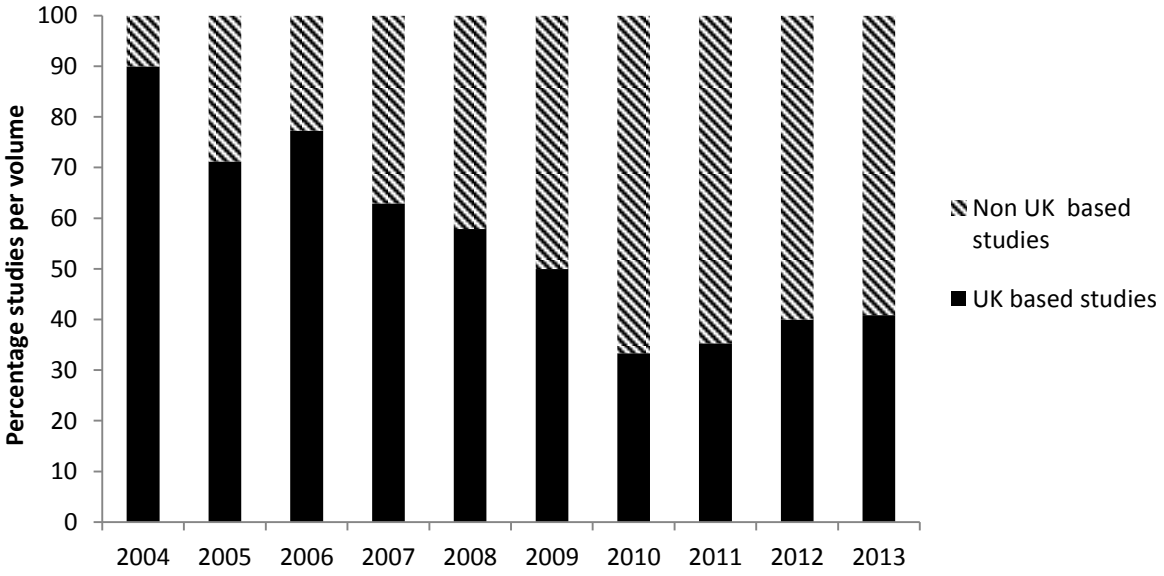

Figure 6. Proportion of UK and non-UK based studies in each volume.

Where were the studies carried out?

There was a bias towards studies carried out in the UK, with 59% of the 264 studies in the UK, 13% in New Zealand and the remaining 28% in 33 other countries. This bias is likely to be due to the majority of contributions in the initial years coming from UK based institutions with which the founders were well connected. For example, the second volume, in 2005, contained 25% of all *Conservation Evidence* articles covered by this review, of which 71% were from the UK. However, since the earlier volumes, the proportion of UK-based studies decreased substantially to 33-41% in the last four years (Figure 6). Since 2006, there have been studies published from at least four continents per volume and since 2011 there have been studies from six continents per volume.

As well as the variation in the number of studies carried out in each continent, there was also variation in the taxa subject to interventions in the studies (Figure 7). For example, studies on invasive animals were predominant on continents that have high numbers of threatened island endemic species, which are particularly vulnerable to non-native species, such as Mauritius in Africa and New Zealand in Oceania.

How successful were the interventions?

Conservation Evidence encourages the publication of unsuccessful as well as successful interventions, as conservation work that does not have a positive outcome often goes unreported. Therefore, it is important to report such cases, so that others can learn from the outcome and either avoid using the intervention in a similar situation or, if conditions are different, try modifying the method.

Different types of conservation intervention are quantified as successful in very different ways. For example, if 50% of

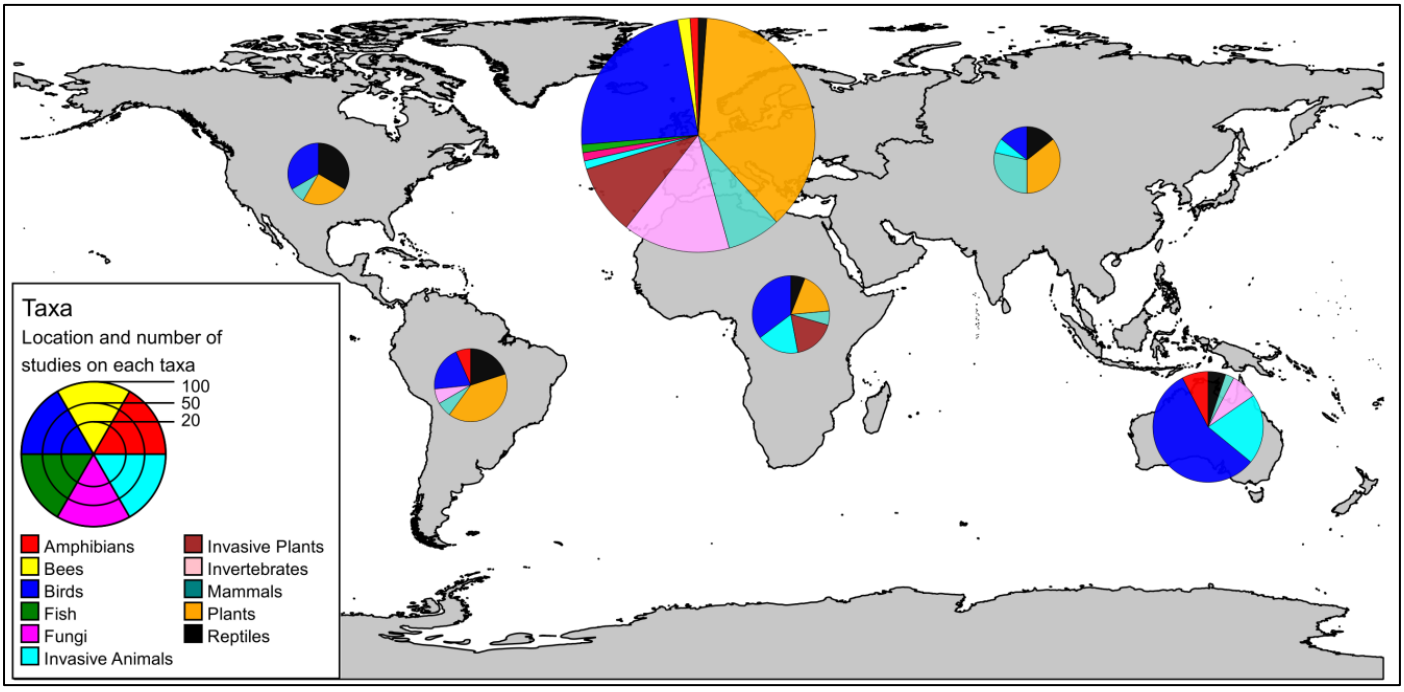

Figure 7. Proportion of papers for each taxon on each continent, with circle size representing the number of papers.

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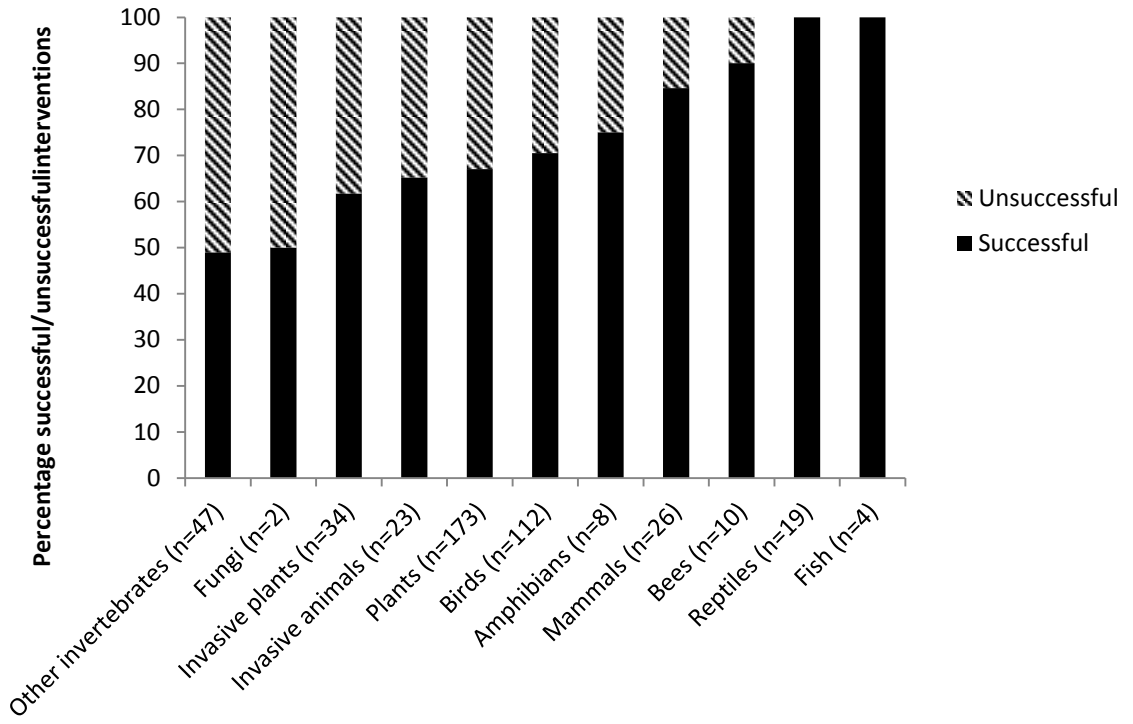

Figure 8. Success rates of interventions described in 239 papers for each broad taxon group. The total number of interventions is 458 as some papers included more than one taxon.

reintroduced individuals went on to reproduce, this may be considered a success. However a 50% population reduction when eradicating an invasive species from a site may be considered unsuccessful, as the invasive species would be likely to recolonize the entire site. Therefore in this review, interventions in each paper were individually judged as successful or unsuccessful by each of the authors of this review, and the majority view taken. Of the interventions published by *Conservation Evidence*, 431 (95%) could be judged on success.

Overall, 296 (69%) of interventions were considered to be successful and 135 as unsuccessful. Success rates differed across taxa (49-100%; Figure 8) and intervention type (0-100%; Figure 9).

DISCUSSION

The goal of *Conservation Evidence*, to provide a format for practitioners to publish results of their work, has been achieved with over 70% of the authorship made up of practitioners. This journal is therefore achieving its aim of providing a home for the sharing of practical conservation knowledge. However, we have yet to sufficiently influence conservation practice such

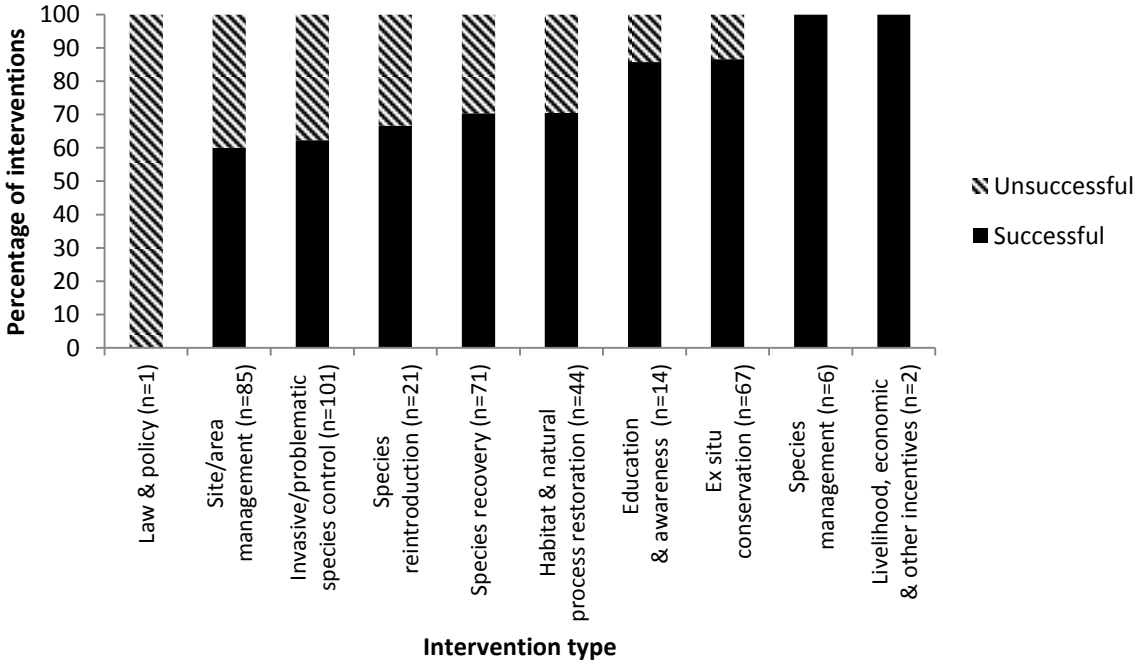

Figure 9. Success rates across the different intervention types.

ISSN 1758-2067

that the testing, recording and reporting of the effectiveness of interventions becomes routine. Smith *et al.* (2014) stressed that as well as testing single interventions, there is a need for the testing of alternative interventions or of variants of one particular intervention, such as treating an invasive plant with the same herbicide at different times of year, in different formulations or by varying methods.

Over the past ten years the papers submitted to and published in *Conservation Evidence* have predominantly focussed on plants and birds, with fish, fungi, reptiles and amphibians somewhat overlooked. The interventions reported most frequently were invasive or problematic species control and site management. Few papers focused on species reintroductions, species management (e.g. trade and harvest management) or the social sciences aspects of conservation. Although in the first few years the majority of studies took place in UK, in more recent years at least 60% of papers were from overseas and from six continents.

There continues to be a high rate of male authorship in the journal. Such a gender imbalance is likely to be a symptom of wider scale gender imbalances in conservation, both in academia and in practice. Studies suggest that conservation biology is similar to a leaky pipe in terms of gender, with biology a popular topic among female undergraduates, but with fewer women progressing up each step of the career ladder (Cameron *et al.* 2013). Pettorelli *et al.* (2013) suggest that journals do have some power to address these issues, and this remains a continuing challenge.

With concerns expressed elsewhere that publication bias has resulted in overestimation of success (Jennions & Møllers 2002, Fanelli 2010, Miller *et al.* 2014), it is encouraging that interventions that were unsuccessful as well as successful have been frequently reported in *Conservation Evidence*. Descriptions and results of interventions that did not work in certain situations provides valuable information to other practitioners, both potentially saving time and money, but also providing a stimulus to find means of adjusting methods to improve effectiveness.

In another ten years we hope that the monitoring of effectiveness, and especially comparing the effectiveness of interventions, is more routine and that there is a more inclusive coverage of taxonomic groups. We also hope that we can continue to expand from our strengths in the UK to increased global coverage.

ACKNOWLEDGEMENTS

We thank Arcadia for funding this process and the authors, referees and editors who made this journal possible.

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ISSN 1758-2067