

Are Journal Impact Factors another key threatening process for Australian fauna?

The potential bias from Journal Impact Factors in the selection of subjects for research and publication

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ABSTRACT

We are concerned at how research agendas of science, and conservation biology in particular, are potentially being deformed by the dominant influence of a single entity, Journal Impact Factors, which in turn reflect the business model of the USA-based global corporate entity Thomson Reuters. We are particularly concerned that this single metric results in systematic suppression of research vital for conservation biology in Australia. We outline the ways by which Journal Impact Factors impact negatively on the kinds of research which underpin the conservation of Australia's biodiversity. We argue that the influence of this scheme on Australian science needs to be changed. A new formula will require a much greater emphasis on an Australian, not an American, perspective, and a decoupling of the metric of impact factor from a business model for publishing houses.

Key words: ISI, journal ranking, ERA, ARC, citation rates, key threatening process.

Problems caused by Journal Impact Factors

To judge whether scientists should be employed, promoted, or receive grant funding, an employer or grant provider will often rely on a quantifiable score of the scientists' research. The quality of the journals in which a scientist publishes is often used as a measure of the quality of the research. In effect, the journal in which the research is published is used as a surrogate for an individual's research quality. The theory is that the 'better' the journal, the better, and more significant, is the research. There is a variety of metrics used to rank these journals, such as SCOPUS's two annual measures of journal usage, SCImago journal rank (SJR) and Source Normalized Impact per Paper (SNIP), as well as a range of values including mean citations/paper, median citations/paper and various eigenvalue statistics (Bryant and Calver 2011; Calver and Bryant 2008; Calver *et al.* 2010; Calver *et al.* in press). However, the most widely used metric is the Journal Impact Factor (JIF). It is the average number of citations received per paper published over the previous two years (Garfield 2006). The international information company Thomson Reuters (parent of the USA-based global corporate entity formerly called Thomson Scientific and Thomson ISI) calculates the index yearly based on journals registered in their Journal Citation Reports.

While this might seem a fair measure of a scientist's worth, in that the standard for acceptance for a high-impact journal is higher than for a lower impact journal, there are negative effects of JIFs for Australian scientists, endemic fauna, and Australian ecosystems (see Bryant and Calver 2011 for a recent discussion). These include:

- a. an ever-narrowing range of research topics, biased against many critical conservation concerns in Australia;
- b. a narrowing of acceptable methodological approaches, with a bias toward purely quantitative methods;
- c. an oddly-stylised way of writing, which makes a paper look international and removes references to local management, conservation and ecological problems. It encourages overused phrases, such as "the rate of biodiversity loss is a global problem", with an international reference (such as Sala *et al.* 2000, which has been cited over 1,500 times), no matter what the research question;
- d. 'international' has a geographic bias towards North America;
- e. not all journals have been assigned a JIF by Thomson Reuters, thereby being excluded from the definition of high-ranking;
- f. the loss of basic ecological field data, which is seen as being too expensive, too lengthy, too localised and too restricted in sample sizes for immediate scientific impact (Noss 1996, Lindenmayer and Likens 2011). It has been predicted that neither meta-analyses nor systematic reviews will be possible in the future due to the lack of field data (Whittaker 2010);
- g. the loss of taxonomic research, because most journals that publish taxonomy are low-ranked (Krell 2000, 2002). Taxonomists are already in decline, hence much biodiversity will be lost without description (Uniyal 2011).

Bryant and Calver (2011) have produced a devastating critique of the limitations of publishing power on science, particularly Australian natural history, and the essential ecological studies needed to understand and conserve Australian fauna. There are other ethical issues for scientists and journals, including ‘unpopular’ subjects and small fields being neglected, and unethical authorship selections (Werner 2009). However, in this paper we concentrate on the more direct impacts on the Australian fauna and its conservation.

A colleague recently complained to us that several of the manuscripts that he had produced for symposia in the past (e.g. on the endangered Green & Golden Bell Frog *Litoria aurea*, published by the Royal Zoological Society of NSW) had more than 20 citations each, yet remain mostly invisible to the international community. This means that Thomson is deciding, on commercial and North American grounds, whether an Australian zoologist’s work gets recognised or not.

In fact, many of our colleagues and students have mentioned to us how their work was obstructively influenced by JIFs:

- by being restricted by excessive emphasis on the elitist approach to publishing;
- the allocation of funding, grants (especially from the Australian Research Council) and academic positions to scientists who maximise their publications in the international literature;
- a change in prestige, and thus support, away from research important to conservation and management at the local scale, particularly in academic institutions.

More recently, the Australian Research Council (ARC) replaced the JIF with the Excellence for Research in Australia (ERA) Index to rank these journals. The ERA ranking system comprised committees of academics who subjectively placed all journals into one of four categories (A*, A, B or C), based on the perceived importance of the journal in the field. This was set aside in 2011, but will be replaced with a similar metric. Although the ERA seemed to have the benefit of being fairer than the JIF to diverse disciplines (studies in zoology, ecology and wildlife research cannot get into journals with high citations such as *Cell*), we believe it would have had the same consequences for Australian wildlife, ecosystems and scientists as the JIF.

Mike Calver (pers. comm. 2011, Murdoch University WA) has pointed out that the ERA changes in 2011 are essentially the end of the ranking system, which will be replaced with ‘a journal quality profile, showing the most frequently published journals for each unit of evaluation’. Calver’s reading is that the ranking system, for all its flaws, was transparent. The ARC’s response has been to create the opaque ‘journal quality profile’, which Calver says will be just as bad, but which will not attract much criticism because nobody knows what it is.

Another view, clearly articulated by Harry Recher (former editor of *Pacific Conservation Biology*) in reading a draft of this paper, is that, “all ranking systems should be dispensed with as being counter-productive in basically the ways the

authors are suggesting. If journals are to be ranked, then we need a quantitative system that objectively scores each journal without prejudice. It is also inappropriate to place all journals in the same basket, as different fields of science differ wildly in the amount of research conducted, funding, number of players, number of journals, and so on. To compare excellent taxonomic research with excellent cancer research is impossible and has only led to the denigration of taxonomic studies, for example.”

Mike Calver, the current editor of *Pacific Conservation Biology*, has taken a strong interest in this matter, which helps others penetrate this arcane world of journal ranking. For example, Calver and Bryant (2008) were able, after some considerable effort, to calculate that *Pacific Conservation Biology* is picked up internationally, despite not having an ISI listing, and that the journal is comparably cited to similar journals that are listed. Calver *et al.* (2010) asked: “what makes a journal international?” From a case study using conservation biology journals, they concluded that the assessments do not reflect on quality, but may aid editors planning distinctive journal profiles, or authors seeking appropriate outlets. Calver *et al.* (in press) analysed *Australasian Plant Pathology*’s authorship and readership 2001–2010, and found that it makes a broad regional contribution with global recognition, given its increasing proportion of authors from outside Australia, the many countries citing it, and its use relative to similar journals. Mike Calver also directed us to the insightful paper entitled: ‘The top-ten in journal impact factor manipulation’ (Falagas and Alexiou 2008). They noted that a considerable part of the scientific community is, at least to some degree, involved in the ‘impact factor game’, and concluded that editors and publishers should strive for quality through fair and thoughtful selection of papers forwarded for peer review, and editorial comments that enhance the quality and scientific accuracy of a manuscript. Thus, a detailed analysis of JIFs and related metrics can yield a story that is far more complicated than how the quality of a paper, and by inference the scientist, is related to a journal’s JIF. It is a misleading statistic and should not be relied upon to judge the merits of either a journal or a piece of research, or the researchers themselves.

We are concerned that some of the finest Australian journals (e.g. *Austral Ecology*, *Emu*, *Wildlife Research*), in aiming for a higher international standing may, in the process, be in danger of being seduced to accept a narrower range of papers (for example less on regional Australian studies and fauna) to gain a higher JIF. This is almost certainly linked to economics. With fewer publishing houses involved, the goal appears to be to make a profit by increasing the market rather than encouraging research or fostering communication which would help the management and conservation of the Australian fauna. The issues are not simple, as may be implied, and, as Harry Recher (pers. comm. 2011) points out, it may be not so much that the journals will have narrowed the range of papers they seek to publish, but that they may place more emphasis on papers from overseas that may not be of the same quality as Australian work they reject.

Does 'international' really mean 'America'?

Most 'high-impact' journals are USA-based (the base of Thomson Reuters), followed by British, European and Canadian journals. A search of the Web of Knowledge (Thomson Reuters' online journal search engine), using 'conservation' as a search term, between the years 1996 to 2007, demonstrates that the vast majority of references come from the USA, followed by England, Germany, France and Canada (Figure 1).

While this dominance reflects relative national research efforts – there has been far more research undertaken and published in North America than Australia – it nevertheless, in our view, tends to bias conservation research towards Northern Hemisphere researchers, taxa and conservation priorities. Australian-based examples are less likely to be used, hence problems unique to Australian landscapes are underplayed as not being 'international' enough. Such unique Australian issues include eucalypt forests, long-distance fauna movement patterns, and the consequences for the biota of the erratic rainfall patterns of the arid inland. One of the ways of addressing this bias is to produce Australian text books, and that was the stimulus for Recher *et al.* (1979, 1986) producing their text, and Calver *et al.* (2009) assembling their outstanding contribution to Australian books in this market. However, recognising the problem is not all that is required. We need to see the Australian issues in our selection of problems to solve, including

how to frame our questions and how we present work for publication. This point is not just for researchers, it is critical that those who judge the scientists and their publications see the value of tackling Australian issues with our national interests at heart.

Journal Impact Factors loom as a key threatening process to the Australian fauna

The hegemony of the JIF listing process, and the possible replacement by a process similar to the ERA, has created a divide between journals deemed valuable and those of lesser importance.

Since many Australian researchers perceive career advancement as depending in part on publication in 'international' journals, authors strive to adapt research programs and publication output to these journals. This implies that local journals, such as *Australian Mammalogy*, *Australian Zoologist* and *Pacific Conservation Biology* (none of which have been assigned a JIF by Thomson Reuters) publish only second-rate science. In our view, these journals exhibit the quality of science, writing and refereeing equivalent to journals benefiting from JIFs, and the high quality science of these journals includes research that is applicable to the conservation of Australia's flora and fauna. We need to be aware of the cultural cringe involved here, which in this case is yielding to the fact that Thomson preferentially lists American journals, and appears only

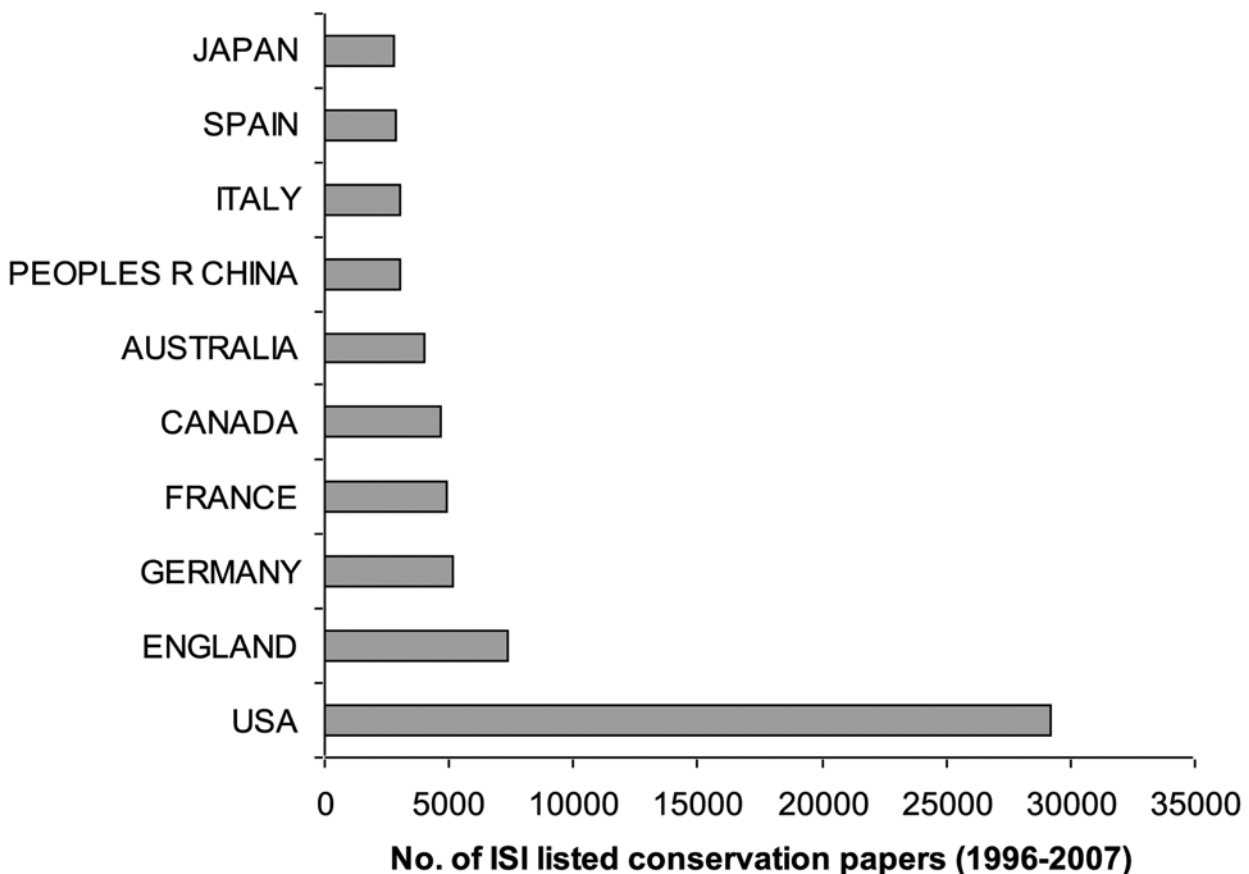


Figure 1. American dominance in the number of Conservation papers in ISI Listed Journals, 1996-2007. Derived from a search of the Web of Knowledge (Thomson Reuters' online journal search engine) using conservation as a search term.

to list overseas journals to provide breadth. If we have that awareness, then we have a chance of not deferring to this ranking system in our choice of research to be done and researchers to promote.

This ‘scientific apartheid’ creates a situation where research topics, critical for the conservation of Australia’s flora and fauna, are excluded or disadvantaged by journal metrics. Such topics include: faunal inventories; descriptive taxonomic studies, e.g. new species; field identification criteria; studies of an individual population; ecological or natural history studies of a locally endemic species; and species not currently in the conservation spotlight, e.g. common species or those of no commercial importance.

In addition, with ongoing research divisions and funding cuts to government departments, less of this vital basic research on the Australian fauna is being conducted. A further irony is that if such studies get into high impact international journals, such as *Nature* or *Science*, they have a much lesser impact on their field than in more specialised journals (Postma 2007).

To illustrate these points, two examples of top-quality scientific studies which have had high but different significance for Australian conservation biology are described.

Example 1: Krefft’s (1866) paper on Murray-Darling junction fauna.

Krefft (1866) recorded species that are now long extinct, such as the numbat *Myrmecobius fasciatus* and pig-footed bandicoot *Chaeropus ecaudatus*. This classic paper would not be accepted by a journal chasing JIFs, yet such papers are still being submitted and will in turn become critical and irreplaceable yardsticks for monitoring environmental change. Further, such studies will not be undertaken if the researcher’s aim is international publication, and if such data were to be acquired in a larger study, it may not be written up because it would take time away from writing the papers for international journals. Adam (2010) has identified the critical role of natural history study and laments its modern neglect. Natural history appears to be suffering from the same issue of being marginalised because of its apparent non-professional standing, which is a related problem because the journals which accept natural history papers do not receive international standing.

Basing impact factors on the past two years of citations discriminates against baseline studies that will be used far into the future, such as Krefft’s (1866) paper, in favour of findings of immediate application, but with a limited shelf life, such as medical work. Faunal survey papers have a long shelf life because they represent a slice of time for endless future reference, even though they have a low immediate citation rate. Hence, *Australian Zoologist’s* commitment to publishing significant fauna survey work, such as Kutt *et al.* (2005). However, on grounds of low international relevance and likely citation rates, Krefft’s paper would be *rejected* by JIF-rated journals.

Papers such as Krefft (1866) continued to be cited at an ever-increasing rate. Consider the early work in the species that you are studying. If it is now endangered, but was once common, then *all* early references take on a heightened value. Similarly, it is important to track the distributional expansion of pest species, and early papers are valuable, as are earlier papers that deal with control methods. For little-studied species, a common issue in Australia, there are so few papers that those published in earlier decades are all that are available. For those who are keen on conserving our native fauna, this has grim implications: scientists and journals will shy away from our little-known fauna.

Example 2: Llewellyn’s (2006) paper on one aspect of the biology of the Australian freshwater fish, the Purple-spotted Gudgeon, published in *Australian Zoologist*.

The Royal Zoological Society Council unanimously endorsed acceptance of this paper and recognised that it contained invaluable data for fish biologists, despite an anticipated citation rate of less than three times over the next decade.

Australian Zoologist has not been assigned a JIF: Thomson Reuters did not respond to several requests from the Royal Zoological Society of NSW in 2002, although the journal is currently being considered for listing. *Australian Zoologist* was to be classified as a C under the ERA, the lowest journal rank. It might be pointed out that, in the ERA scheme, 50% of all journals fell into this category. Thus, judging scientific merit only on international publication citations and the journals in which papers have been published discriminates against sound, basic science on native Australian fauna. So insidious was this ranking system, that some universities were advising staff not to submit their papers to C class journals (Shelley Burgin RZS council member, pers. comm. 2010), while others advised staff not to serve on editorial boards or referee papers for any but the top-ranked journals (Harry Recher, pers. comm. 2011). This would be another blow to the broader endeavour of ensuring that the basic science of Australia’s fauna is published and permanently available. Not only do we need a metric that is fair to the scientists, we critically need one that values our native fauna and encourages such study. We need a diversity of metrics to reflect the diversity that we see in our scientists, or better still, dispense with any ranking system, because each version leads to inequalities for both scientists and the subject of Australian fauna, and no system of ranking can be objective.

With little apparent international relevance, Llewellyn’s (2006) fish paper would have been *rejected*, had JIF been the goal of *Australian Zoologist* and the Royal Zoological Society of NSW. We already suffer a knowledge gap with respect to our native fauna, and failure to publish due to rejection based on not fitting the definition of ‘international relevance’ accentuates this deficiency.

A dilemma facing scientists: what to study and what component of their data to publish?

Some topics selected for study will be immediately relevant internationally, and that is a draw for some scientists, and their relevance to conserving Australian fauna or ecosystems is a secondary consideration. If such a view were to be rewarded with more grants, better employment prospects, and status in the scientific community, then that view will become the norm. Then only the more committed, but less ambitious, researchers, would put local conservation issues first. Let us suppose survival in the scientists' 'rat-race' matters, then the issue becomes "what parts of the data sets gathered in any one study are to be published?" The first priority is to submit papers to international journals and, if there is time, then papers that are of little or no international relevance are submitted to local journals. The latter might include papers reporting fauna surveys of the local area in which the study was conducted, or measures to alleviate local conservation issues. If these distract the scientist from moving on to the next international paper, or a study leading to an international paper, then the local material is lost. The conservation tragedy mounts as more and more of such studies remain unpublished, or unresearched.

Another issue is the length of papers. International journals usually specify the maximum number of journal pages per paper, e.g. in highly ranked journals, 6-10 journal pages is the standard. Does science really work in such tight units? Some subjects are ill-suited to such restrictions. Historical accounts of environmental change are usually long, as are reviews of a major field, and some crisp observations only warrant two pages. Both the long and the short fall by the wayside on the international scene, yet both may well be high-quality science and of great academic merit, but not commercially worthwhile for an international journal, or one aiming for international standing.

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A dilemma facing journal editors: Do you accept a paper that is likely to be rarely cited?

Journal editors are caught in the same trap as scientists wishing to publish their research, in that the citation rates of published papers are used as a measure of their quality. Acceptance for publication of papers on relatively obscure topics, or of interest to a limited audience, is mostly limited to journals prioritizing, for example, conservation of Australia's biota, adherence to the basic tenets of science, or papers which are unusual or innovative. On the other hand, such papers will not be accepted by those editors, editorial panels and publishing houses which seek fame and fortune via the path of JIFs.

Conclusion

Journal Impact Factors impose an inappropriate corporate ethic on scientific publishing, and should not be the major metric used to allocate resources, determine academic appointments and gauge the value of Australian zoological research. In our view, being beholden to JIFs produces research and publication outcomes which obstruct, by distorting research priorities, the conservation of Australia's biodiversity. The influence of this scheme on Australian science needs to be corrected. A formula that gives Australian fauna and Australian ecosystems a stronger weighting is needed so that Australian scientific studies and their publication in quality journals are encouraged. This will require a greater emphasis on other criteria than Journal Citation Report listing, and a decoupling of the metric of Journal Impact Factor from a business model for publishing houses. To persist with a system that gives so much weight to journal ranking, based on JIFs, is to downgrade the scientists and subject matter that promulgate sound science but with a focus on Australian fauna, ecosystems and their conservation. In short, Journal Impact Factors place science, or at least Australian zoological science, under siege.

Hudson, Mike Letnic, Bronwyn McAllan, Harry Recher, Mike Thompson and Jonathan Webb, and editing by Chris Moon.

References

- Adam, P. 2010. The study of natural history – a PPP. Pp 1-15 in *The Natural History of Sydney*, edited by D. Lunney, P. Hutchings and D. Hochuli. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Bryant, K. A. and Calver, M. C. 2012. Adaptive radiation in Australian journals in the Arbustocene ERA: an empty niche for JANCO? Pp XX - XX in *Science under Siege*, edited by P. Banks, D. Lunney and C. Dickman. Royal Zoological Society of NSW, Mosman, NSW, Australia.
- Calver, M. C. and Bryant, K. A. 2008. Pacific Conservation Biology: An authorship and citation analysis. *Pacific Conservation Biology* 14: 285-303.
- Calver, M. C., O'Brien, P. A. and Lilith, M. In press. *Australasian Plant Pathology: an analysis of authorship and citations in the 21st century*. *Australasian Plant Pathology*.
- Calver, M., Lymbery, A., McComb, J. and Bamford, M. (eds), 2009. *Environmental Biology*. Cambridge University Press, Port Melbourne, Victoria, Australia.
- Calver, M., Wardell-Johnson, G., Bradley, S. and Taplin, R. 2010. What makes a journal international? A case study using conservation biology journals. *Scientometrics* 85: 387-400.
- Falagas, M.E. and Alexiou, V.G. 2008. The top-ten in journal impact factor manipulation. *Archivum Immunologiae et Therapiae Experimentalis* 56: 223-226.

- Garfield, E.** 2006. The history and meaning of the Journal Impact Factor. *Journal of the American Medical Association* **295**: 219-221.
- Kreffit, G.** 1866. On the vertebrate animals of the lower Murray and Darling, their habits, economy and geographical distribution. *Transactions of the Philosophical Society of New South Wales* **1862-1865**: 1-133.
- Krell, F.-T.** 2000. Impact factors aren't relevant to taxonomy. *Nature* **405**: 507-508.
- Krell, F.-T.** 2002. Why impact factors don't work for taxonomy. *Nature* **415**: 917.
- Kutt, A.S., Kemp, J.E., McDonald, K.R., Williams, Y., Williams, S.E., Hines, H.B., Hero, J.-M. and Torr, G.** 2005. Vertebrate fauna survey of White Mountains National Park in the Desert Uplands Bioregion, central-north Queensland. *Australian Zoologist* **33**: 17-38.
- Lindenmayer, D. B., and Likens, G.E.** 2011. Losing the culture of ecology. *Bulletin of the Ecological Society of America* **92**: 245-246.
- Llewellyn, L.** 2006. Breeding and development of the endangered Purple-spotted Gudgeon *Mogumda adspersa* population from the Murray Darling. *Australian Zoologist* **33**: 480-510.
- Noss, R.** 1996. The naturalists are dying off. *Conservation Biology* **10**: 1-3.
- Postma, E.** 2007. Inflated Impact Factors? The true impact of evolutionary papers in non-evolutionary journals. *PLoS ONE* **2**: 1-5.
- Recher H., Lunney, D. and Dunn, I.** 1979 (2nd edn 1986). *A Natural Legacy. Ecology in Australia*. Pergamon Press, Rushcutters Bay, Sydney, Australia.
- Sala, O. E., Chapin, F. S., Armesto, J. J., Berlow, E., Bloomfield, J., Dirzo, R., Huber-Sanwald, E., Huenneke, L. E., Jackson, R. B., Kinzig, A., Leemans, R., Lodge, D. M., Mooney, H. A., Oesterheld, M., Poff, N. L., Sykes, M. T., Walker, B. H., Walker, M., and Wall D. H.** 2000. Global biodiversity scenarios for the year 2100. *Science* **287**: 1770-1774.
- Uniyal, S. K.** 2011. Prioritizing taxonomy. *Science* **332**: 536-537.
- Werner, Y. H.** 2009. The aspiration to be good is bad: the 'Impact Factor' hurts both science and society. *International Journal of Science in Society* **1**: 99-105.
- Whittaker, R. J.** 2010. Meta-analyses and mega-mistakes: calling time on meta-analysis of the species richness-productivity relationship. *Ecology* **91**: 2522-2533.