

*Publications are at the heart of 21<sup>st</sup> Century ecology. Many of us will have heard a variant of 'It's not science until it's published', and the pressure to publish for personal career development has never been greater. Publications are central to the BES too, providing important international exposure as well as a substantial proportion of our income. Here, we present an overview of journal publications as they affect both BES and the struggling ecologist. Lindsay Haddon and Sue Hartley, Publications Manager and Publications Chair respectively of the Society, outline the changing face of scientific publication as it affects the BES, and Liz Baker, Managing Editor of Functional Ecology answers all your questions about what happens when you submit your precious manuscript to a BES journal (Box 1). Peer review is central to the quality of scientific publication, and Bob O'Hara (Box 2) confronts recent debate over how best to ensure the process is fair and open. Looking to the future we consider some of the innovations which are seeking to open up the world of scientific publication to new technologies and means of communication (Box 3). Finally, as a coda to the feature we present a bluffer's guide to some of the bibliometric indices increasingly employed to assess the quality of published research (and published researchers).*

**Tom Webb & Alison Holt**



A venture that started largely as a service to the ecological community – somewhere ecologists could read about the best research carried out by their colleagues – has developed into something of much wider value to the Society. Not only does the BES's reputation benefit from being the professional body behind four of the world's top twenty ecology journals, but subscriptions also generate a large income, without which the Society would be unable to pursue the activities, initiatives and services to members we do now. To mention just a few of these, the grants to early career scientists, the support for students to go to conferences, the fellowships for scientists in developing countries and the major initiative to foster ecological societies in developing countries and eastern Europe all depend critically on the income from our publications. There's no pressure there then! So the BES needs to maintain, and preferably grow, the readership of its journals, and the key to this objective is ensuring they retain their reputation for excellent quality and being at the forefront of ecological science.

## Why does BES spend so much time worrying about publishing?

Lindsay Haddon, Publications Manager  
Sue Hartley, Publications Chair

The fact that *Journal of Ecology* is as old as the British Ecological Society itself shows that increasing access to ecological information has always been an important part of our mission. As the scope of ecology expanded, and the emphasis on different aspects of the subject changed, we added *Journal of Animal Ecology* (1932), *Journal of Applied Ecology* (1964) and *Functional Ecology* (1987) to our portfolio. Even today, 'Possible new journals' appears as an agenda item for a Publications Committee meeting at least once every 18 months, although the criteria for setting out on such a project have never stayed the same for long – and continue to change very rapidly indeed.

Ensuring that the BES journals remain first choice journals for authors, libraries and, indeed, BES members, in the face of rapid changes in the publishing world is a considerable challenge. Over the past 10-15 years there has been a succession of developments, from the advent of electronic publishing to the establishment of institutional repositories, each of which might have been the death of journal publishing as we know it. However, although many have triggered changes in the way we go about our business, none has yet been as catastrophic as predicted – we seem to be in a process of evolution rather than extinction!



### Box 1: The Publication Process Explained

*Liz Baker, Managing Editor Functional Ecology*

#### Introduction

Your manuscript is finally finished, you have chosen a suitable journal to send it to and now you are ready to submit the paper. Five years ago this would have involved a large envelope, up to 5 printed copies of the paper and a stamp. Nowadays, you need never print a hard copy of your paper or have postal communication of any sort with the editorial office of a journal. The electronic manuscript tracking systems now used by most journals are fast, paper-free and, with e-mail communication, almost instant. All stakeholders in the process have benefited from this progress.

For all this change, the actual editorial stages your manuscript passes through from submission to decision, and possible eventual publication, have remained essentially the same. I hope the following will help to shed some light on this process...

#### Submission

The BES journals use a system called Manuscript Central (<http://mc.manuscriptcentral.com/besjournals>) which will take you through a number of screens which have to be completed prior to submission. All have detailed instructions to guide the author on the way – and if you have followed the author guidelines for the journal (found on each journal's homepage) in preparing your manuscript, then submission should be very straightforward. Completing the process can seem time consuming and it is easy to get impatient when the system jams, or red messages appear to indicate that you have missed a required field. However, remember how it used to be waiting by the photocopier or printer, using the franking machine or visiting the post office, before then waiting for manuscripts and correspondence to cross the world. Web-based submission really is so much easier and quicker, plus there are almost no costs to the author.

Submission is confirmed by an automated e-mail. With nearly 3000 manuscripts submitted to the BES journals each year, unfortunately we just do not have time to send each author a personal message. However, there are real people behind the system and the editorial office staff are there to help if problems do arise.

#### Initial Screening

The first person to see your paper will be a representative from the editorial office, either a Managing Editor or a Journal Administrator who will check to make sure that there are no technical problems, such as a fault with the PDF opening, and that all the essential material requested – such as the abstract and justification statement – have been included. If you haven't followed the journal-specific guidelines or your manuscript is inappropriate, it will be returned quickly at this point. What do we mean by inappropriate? Well, for example the *Journal of Ecology*, as most BES members know, is a plant ecology journal, but their Managing Editor will each month receive one or two papers on animal ecology. Another example might be where an author decides that the journal ought to receive a full chapter from their PhD thesis: if a journal sets a limit of 7,000 words a 13,000 word paper would not be acceptable.

Once this initial check has been completed the paper is sent to one of the journal's team of senior editors. Their names are published on the front cover of each journal to acknowledge the huge contribution they make to the success of the BES journals. These editors will reject a certain percentage immediately based on their academic assessment of the work and the fit within the scope of the journal. Usually this would be up to 25% of manuscripts depending on the journal. Although each journal has a named executive editor they each work as part of a team with their co-editors and they are the guardians of the academic content of the journal.

Each journal also has an international editorial board made up of about 50 associate editors. These board members cover a range of expertise and provide the editors with a panel of specialists to refer papers to for a more detailed assessment. Again these associate editors will immediately recommend rejection of a paper if they do not feel that the science is sufficiently

good or that the paper does not reach the standards that the journal is looking to achieve. Whether it is the senior editors or a member of the editorial board who advises that a paper is rejected from the editorial process at this stage, a reason for this will be provided in the decision e-mail sent to the authors.

#### Peer-review

If your paper has been lucky enough to make it through this initial screening process, it will next be sent for external review. The editor responsible for handling the manuscript, who will usually be the associate editor or senior editor whose expertise is closest to the subject of the paper, will invite between 2 and 3 reviewers to consider the paper. The selection of reviewers is designed to provide a fair, objective and constructive evaluation of your work. The editors select reviewers from a very large database covering all four BES journals and this database is being added to constantly. If you have recommended some reviewers during the submission process sometimes the editors will select these people in addition to the choices of their own. Even if you have listed a reviewer as non-preferred, the editor may decide that their opinion would be useful. The editor will take any reasons you give into account when selecting or evaluating the report of a non-preferred reviewer, so make sure you explain why, whether it is because they were your PhD supervisor or because they took you to pieces the last time you presented at a conference.

Obviously, some of the reviewers we invite may be unavailable to provide an evaluation – maybe they're too busy, the timing may be bad (the invite arrives just before they're off to Borneo for 3 weeks on fieldwork) or they no longer work in the area. Where a reviewer does agree to offer their opinion on a paper, the journal expects to receive a thorough, constructive review, not only to help the editors make a decision on the paper but also to provide you, the author, with genuinely helpful feedback that you can use to improve the paper whatever the outcome. If the first 2 or 3 reviewers approached by the journal agree to review the paper and return their comments within the requested 3 weeks you should receive a decision well within the target times to first decision advertised by the journals. Unfortunately reviewers do not always agree to review or, frustratingly often, even when they do, their comments take longer than expected to arrive. Sometimes circumstances change where the reviewers do not return their comments at all. This is when the review of a paper may take longer than you are expecting. The editorial office will try to keep authors informed as soon as they are aware that a review is likely to be very late but it is still worth checking if you are unsure.

#### Recommendation and final decision

When all reviews have been received, the manuscript is sent to the handling editor for a recommendation. This is where the reviews are looked at in detail and the manuscript is re-read. Reviewers are asked to complete a scoresheet with their comments on the paper. This consists of some basic questions about the paper with a checklist of yes and no answers, an area for their comments – both confidential to the editor and those for transmission to the author – and their overall recommendation, for the editor's consideration. Where the handling editor is one of the Associate Editors, their recommendation is made to the Executive Editor who will make the final decision. The Executive Editor holds a key position. Although they usually confirm the recommendation, they often have to make difficult decisions as to what is published. In order to publish papers of the highest quality, within tight page budgets and against a background of steadily rising annual submissions to each journal some papers with relatively enthusiastic reviews and recommendations may end up being rejected.

The final decision should arrive direct to your inbox (a copy of this letter is also available in your personal author site on Manuscript Central). Whatever the final decision, you should expect to receive a detailed reason for the decision and constructive comments on how the paper could be improved.

#### Revisions or resubmission

When authors are invited to revise their paper the journal expects each point raised by the editor and reviewers to be considered and an explanation provided of how that point has been addressed in the revised version of the paper. If the journal is interested in your work but your paper needs substantial revision it may be declined and you will be invited to

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resubmit the paper as a new manuscript. This is an indication that in its present form it does not meet the quality standards for that journal and that the revisions required are significant. This decision also allows the authors more time to make the necessary revisions expected. Where a revision or resubmission decision is made there is no commitment by the editors to publish and they may still reject the paper if they are not satisfied with the changes made to it.

Major revision papers and those resubmitted will almost always be re-reviewed: sometimes by the original reviewers and sometimes by new ones.

Even if your paper moves through the editorial process smoothly you should still expect to be asked to revise your paper at least once before a firm commitment to publish is made by the editors. Even when the paper is close to being ready for publication, the editors and managing editors may well ask for minor editorial corrections to be made. Sometimes these seem very minor but they are part of maintaining the quality of the published work. A published paper forms part of the public archive and therefore should not only contain good science but also good English, punctuation and grammar. During the final stages of the editorial processing you will also be asked for other material where applicable such as a signed exclusive licence form permitting publication of the article, a signed colour artwork agreement form where there are colour figures to be published, supplementary materials, a lay summary and possible cover images.

### Decision time

When a commitment to publish is made it is good news for the journal as the peer-review process comes to an end and the journal has a quality manuscript to publish. Equally it is good news for you – your work can now be disseminated to an international audience and this, in turn, may well have a knock-on effect for your department and your career.

If your paper is not successful with one of the BES journals we always hope that the service you have received from the editorial teams has been friendly and efficient. The BES journals are all in the top 20 out of 114 ecology journals in the ISI rankings (see *Bluffer's Guide to Bibliometrics* below) which means there are many, many other journals where your work could be published. If you feel strongly that the journal has made the wrong decision about your paper, take a deep breath and wait for a couple days to carefully assess what reasons the journal has given for declining your paper and then write a detailed, polite and well-argued response to the editors appealing the decision.

### Production

Once a paper has been accepted the editors and editorial office hand the paper over to the publishers who begin the production process. The four BES journals are published by Wiley-Blackwell, one of the largest publishing houses in the world. Progress of your paper through the stages of proof-reading and typesetting can be monitored using Author Services on the Blackwell Synergy website. As soon as the final typeset version of a paper is agreed it is now published 'Online Early', often several weeks in advance of print publication...

The BES journals rely on the submission of high quality papers for consideration by their editorial teams. It is hoped that each author who submits, whether successful or not, will give back into the peer-review process some of their time to become reviewers themselves helping other authors along the way as well as learning more about the work in their field. Maybe one day you will want to become an editor of a journal, maybe even a BES journal.

Members cannot fail to have noticed one of the biggest changes in recent years – the shift from print to on-line publishing. Many of you will have seen your institutions provide increasing electronic access at the expense of print, and those of us teaching students will be making increasing use of electronic formats in our delivery. The pdf is king these days! The effect of on-line publishing on print journals has been compared to that of the invention of the printing press on mediaeval manuscript production, but the change is much

more rapid: most librarians expect to stop taking print within the next five years, compared with the tens or hundreds of years it took for monastic scriptoria to go out of business. BES publications are reflecting this rapid pace of change: it is predicted that, by the time of the London Olympics in 2012, over 80% of the institutions subscribing to each of our four journals will be taking only the online version and that print versions will be becoming increasingly unsustainable.

### Box 2: Peer-review, bias, and (double) blind alleys

*Bob O'Hara, Department of Mathematics and Statistics, University of Helsinki*

The traditional single-blinded approach to journal review is in a perpetual state of criticism. One perceived problem is that referees make their assessments based on the identity of the author(s), rather than just on the quality of the paper. This could bias the reviews if the decisions are based on, for example, the gender of the author; their geographical origin and/or place of work; or on whether the author is well known and/or does work supporting the views of the academic editor or editorial board. An obvious fix for this problem is to double-blind a review: i.e. the reviewers are simply not told the identity of the authors. Sounds great, and a recent survey found that scientists liked the idea, but on further inspection things get more complicated.

Is there more than anecdotal evidence that referees hold up papers, or give bad reviews to known authors who disagree with them? So far, there is little data supporting a qualitative difference in reviews when author identity is masked [1,2]. One specific argument in favour of double-blinding is that it removes biases against women authors. But evidence for this effect is at best contentious [3,4,5], and until the data on which it is based is fully re-analyzed, the jury is still out.

However, whether or not it is beneficial to journals, double-blinding does not even work: the proportion of referees that correctly identify the author has been estimated at 32 [2] and 46 [3] percent. An author is more likely to be recognised if they are known to the reviewer, but this is the same factor that can bias a reviewer in favour of the author. Thus, the two biases may even act together to make the situation more complicated [6]; particularly in niche specialties with small followings.

So, should journals propose double-blind reviewing? There is little evidence that it is beneficial, and the overheads, in terms of ensuring effective blinding, are costly and difficult to define. One point in favour of double-blinding is that it might attract better manuscripts: whether or not there is a real effect on the subjective nature of reviews, a perceived effect may lead some authors to submit to a journal because they think they will be more successful. So, even though double blinding may not improve the review process, it could improve the quality of submissions to journals using it.

### Acknowledgements

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<sup>1</sup> van Rooyen, S., et al. (1999) *Effect of Blinding and Unmasking on the Quality of Peer Review*. *J. Gen. Intern. Med.* 14:622–624.

<sup>2</sup> Justice, A.C., et al. (1999) *Does Masking Author Identity Improve Peer Review Quality?: A Randomized Controlled Trial*. *JAMA*. 280: 240-242.

<sup>3</sup> Blank, R.M. (1991) *The effects of double-blind versus single-blind reviewing: experimental evidence from The American Economic Review*. *The American Economic Review* 81: 1041-1067.

<sup>4</sup> Webb, T.J. et al. (2008) *Does double-blind review benefit female authors?* TREE, in press. DOI: 10.1016/j.tree.2008.03.003

<sup>5</sup> Budden, A.E., et al. (2008) *Response to Webb et al.: Double-blind review: accept with minor revisions*. TREE, in press. DOI: 10.1016/j.tree.2008.04.001

<sup>6</sup> <<http://deephoughtsandsilliness.blogspot.com/2008/02/fame-journals-and-blinding.html>>. Blank (1991) has evidence that middle-ranked institutions fare worse under double-blind review, which could be used to support these conclusions, but scepticism towards this is warranted until more direct evidence is obtained.

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What will be the impact of the loss of print for the BES?

Early fears that no-one would be prepared to pay a similar amount for access to an electronic product as for the delivery of paper copies, or that journals would become little more than a source of links to articles to which they had given their stamp of approval, have proved unfounded. In fact, many new ways have emerged to add value to electronic content and publishers have come up with electronic delivery systems and payment models that satisfy both librarians and end users. As a result, BES journals are continuing to see rapid increases in readership (30% higher in 2007 than 2006) and steady (4-5%) increases in income. The ongoing decline of print therefore seems likely to be a minor threat to the continued success of journals in general, and the BES stable in particular, as long as we maintain the high editorial and scientific standards for which our journals are known. This is what really determines the value of a journal, not its mode of delivery. Not that we can afford to sit back and relax -clearly we need to ensure that we exploit the innovative potential of electronic publishing. One challenge is to keep pace with the latest developments that our readers and authors want to see, so it could, for instance, be time for authors to start practising their podcasting (see Box 3)! We also need to think about the consequences of the potential loss of print for those members who do not have easy access to electronic versions. Overall, however, the move to electronic formats should widen our reach rather than reduce it.

A potentially very serious issue for the Society, in terms of maintaining the income from journals, is the development of open access publishing, in which the author of an article (or the organisation which funds his research) is charged a fee and the article is then available to anyone, without charge, as soon as it is published. Although this does provide an alternative income stream, the charge needed simply to cover the editorial, production and dissemination costs of an article runs to four figures, and the larger amount needed to compensate for lost subscription revenue would be beyond the reach of many authors. This 'author pays' model has been around for ten years now, but it only began to gather real momentum more recently, after the much publicised launch of PLoS Biology in 2003. Open access journals can (and do) thrive in fields where a majority of researchers support OA in principle or where there is a funding body with the financial resources to compensate authors for the costs involved, and the political or professional influence to mandate OA. So far, this is largely restricted to biomedicine, where many journals already make back issues free after six months. This early release is possible because the research concerned has

a short 'half-life' (i.e. it becomes out of date very rapidly; see *Bluffer's Guide to Bibliometrics* below) so subscriptions are still worth taking out, just to get access for that short initial time period. The BES's Publications Strategy Group, supported by Publications Committee and Council, took the view that such a short 'embargo period' would potentially damage subscriptions and the associated income too severely, and that a longer embargo is justified for research areas like ecology, where papers are read and cited over a much longer period than in medicine. We opted for access to BES journals to be protected, i.e. to be available only to subscribers, for 24 months. Thus far, this seems to have been acceptable to all parties – libraries, funding agencies and authors – but we are keeping a close eye on this issue. We acknowledge that some contributors will want (or be required to make) their papers immediately and freely accessible, so we have an author-funded 'online open' option, which is currently taken up by a small number (around 1%) of authors.

The issues we've considered so far have largely been related to maintaining income, but the overriding issue in publications is maintaining quality, and one new development is potentially a threat to this. Some organisations associated with a published paper, such as the author's home institution, are beginning to encourage (or even require), the posting of the manuscript on the organisation's own electronic repository. There is no consensus yet as to the 'best' response to such requests. Allowing posting of the published article means that the final polished product is free to anyone prepared to wait until after the embargo period. Some publishers attempt to protect the time and money they have invested by allowing posting of only the author's own 'final version' of the manuscript (again after an embargo period), but this means that there are two, possibly significantly different, versions of the paper in circulation. Posting the version of the paper produced before review has even more unpleasant implications for science quality! At the moment, many repositories will accept posting a link to the article on the publisher's website and, as long as this remains the case, there is no reason why journals and repositories cannot coexist. This is an area that we need to keep under review, not least because it is by no means clear that institutional repositories are sufficiently well resourced to be a credible alternative archive to that provided by publishers. It is tempting to think that these issues are less significant for electronic versions of journals than print ones, but our scientific legacy needs conserving and protecting no matter what its format.



**Box 3: The future of publishing?***Alison Holt and Tom Webb*

The value that is placed on publishing in the primary scientific literature (discussed later in this feature) dissuades many ecologists from making non-traditional choices with regard to where and how to publish their work. However, traditional publishing may not be the dissemination tool of choice for all forms of information. We thought it would be interesting to explore new and exciting publishing possibilities – so-called ‘Publishing 2.0’. There are several innovative developments poised to change the publishing landscape dramatically, and we present three below.

**New models of interactive peer-review in online journals**

A new breed of journal is emerging with a slightly different way of doing business. These are open-access peer-reviewed journals that appear only online, with publication costs borne by the author. Advantages include high throughput, a fast publication time and worldwide access, although the ‘author pays’ funding model is not without problems. Freedom from the strictures of printed journals also paves the way for further innovations, such as those pioneered by *PLoS ONE* ([www.plosone.org](http://www.plosone.org)), which publishes across all scientific disciplines but already contains plenty of ecological content. Manuscripts are peer-reviewed prior to publication, as in traditional journals, but there is a rather different approach to assessing the impact and quality of its articles: peer-review can continue post-publication, as readers add their comments on the paper and on previous reviews. *PLoS ONE* does not have an impact factor and does not intend to acquire one, instead using readers’ comments to judge how important different papers are.

**Preprint archives**

Having somewhere to place manuscripts before publication, or work that is not suitable for a peer-review journal may be very useful. Certainly pre-print archives are used a great deal in mathematics and physics (e.g. arXiv). One to look out for is Nature Precedings ([precedings.nature.com](http://precedings.nature.com)), a permanent, citable archive for pre-publication research and preliminary findings from all scientific disciplines. Perhaps its biggest attraction is to provide a place for researchers to share documents other than formal manuscripts, which nevertheless represent quality work and an investment of time. Examples include conference presentations, posters, white papers, technical papers, and supplementary findings. It provides a rapid (but not peer-reviewed) way to disseminate emerging results and new theories, solicit opinions, and record the provenance of ideas. It also makes such material easy to archive, share and cite, and is certainly worth browsing to see what may be in the pipeline (as with *PLoS ONE*, there’s plenty of ecology there already).

**Video publications**

Written word and static picture-based traditional print journals are no longer always sufficient to accurately transmit the intricacies of modern research. Video publications offer rapid transfer of knowledge both within the research community and to the general public. The Journal of Visualized Experiments (JoVE, [www.jove.com](http://www.jove.com)) is a peer reviewed, open access, online journal devoted to the publication of biological research in a video format. It was established as a new open-access tool in life science publication, and takes advantage of video technology to capture and transmit the multiple facets and intricacies of life science research, using visualization to facilitate the understanding and efficient reproduction of both basic and complex experimental techniques. There is no ecological content as yet, but also no reason why not. Online functionality can also be used to publish complex visualizations as supplementary material in traditional journals, for example, 3D or animated representations of complex ecological models.

In order that they might take off, initiatives such as those described above require strong support from the scientific community, and it can be daunting to take the plunge into non-traditional waters. Nevertheless, escaping from the strictures of formal scientific publications can be fun and rewarding, and considered as complementary to more traditional forums for reporting research findings (such as the BES journals), these new outlets have great potential to make the communication of ecological research more effective.

*This feature was inspired by Wunderlich, Z. & K. Kuchibhotla (2008) Non-traditional publishing choices can enrich science. Nature 451: 887; see also the Harvard Publishing Forum website ([www.harvardpublishingforum.com](http://www.harvardpublishingforum.com)) and the Nature Network Forum on this topic ([network.nature.com/forum/harvardpublishingforum](http://network.nature.com/forum/harvardpublishingforum)). Thanks to Zeba Wunderlich for information and comments.*

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The BES will be better equipped to deal with the current and future challenges in publishing if it chooses its partners carefully: the right contract publisher will help us assess the risks to our journals and advise us on the options available to mitigate these. The BES last put its publishing contract out to tender in 2001, when a new agreement was signed with Blackwell Publishing. Blackwell has served the BES well over the years, delivering steady increases in both readership and income, but the Society regularly reassesses the contract to make sure that it remains fit for purpose in a changing world and to ensure that the agenda of the contracted publisher remains in sympathy with ours. Our current contract is a profit-sharing agreement, so that it is in the interest of both sides to make the operation as successful as possible, but we need to think of our publishing partner as a friendly competitor as well as a provider of professional services. Wiley-Blackwell's position as the leading publisher of ecology journals certainly gives us greater leverage in the market, but it means that they are managing many other ecology journals, some of which they own themselves, and that they have other interests to safeguard as well as the BES's!

Our best chance of 'winning' the competition among ecological journals, whether Wiley-Blackwell ones or not, is by ensuring that our editorial standards are the best around, and that our journals continue to anticipate and fulfil the needs of their respective subject areas. The good news is that widespread concern about issues such as climate change, conservation and biodiversity seems likely to ensure that ecology as a subject area will continue to thrive. The BES journals may have to see off competition from new journals, or existing journals moving into their territory and competing successfully for good material, but there is no reason why we cannot turn increasing interest in ecology into an opportunity. We need to establish our journals as the place to publish on particular emerging topics, even before an area has developed enough to merit its own specialist journal. To carry out this sort of "horizon-scanning" successfully, and to develop and share best editorial practice, it is important that the BES and the teams responsible for each journal continue to engage fully, not only with each other, but also with Wiley-Blackwell. At our Journal Strategy days, journal editors, the BES publications team including all the journal managing editors, Wiley-Blackwell representatives and BES Council members meet together to discuss both new initiatives to increase journal impact (see Box #), and the long-term outlook for BES publications. Our most recent strategy days were in April and were very successful, despite (or possibly because of!) the Publications Chair having flu. Each journal

will be producing a development plan highlighting how they will move forward over the next 1-3 years, and we are planning a "brain storming" meeting in the autumn to identify and consider the strategic issues facing publications over the next 10 years.

The future for BES publications seems secure at present: subscriptions are decreasing more slowly, and downloads are increasing faster, than for most ecology journals, suggesting that stable and predictable growth in income is possible, albeit it at a modest rate. We do, however, need to focus on the online version as a BES 'product' in its own right, adding more types of content, and taking advantage of the online format for increasing interactive features (see Box 3) – the Wii/Grand Theft Auto IV generation of readers and subscribers will expect a lot more from their online subscriptions! But the real key to our successful future is very simple: publishing top quality material. To achieve this objective we depend critically on you – BES members. We rely on you to make sure your institutions continue to subscribe to the journals, by recommendation as well by registering their value by reading them yourselves. We also need you to review papers for them, to support them as Associate Editors and Editors and last, but certainly not least, to write for them! (What happens when you do is explored in Box 1.) Our aim is for the BES journals to your first choice for your best ecological work. We look forward to hearing from you!

### A bluffer's guide to bibliometrics – or, how should we measure science?

Tom Webb

Gone are those halcyon (and, in all probability, apocryphal) days when scientists were given a big pot of money and told to get on with something interesting. Now, accountability is expected at every level: individuals must justify their existences within institutes, research councils squabble over their share of the central government pie. This accountability requires that we put a value on the science we produce, and publication in the primary scientific literature has become, for those of us employed in UK HEIs anyway, the pre-eminent means to derive this value. But simple counting numbers of publications seems an unsatisfactory measure of scientific quality, and so a range of bibliometric indices have been adopted in an attempt to turn this rather intangible notion of 'quality' into



something quantifiable. Of course, this conversion process is far from perfect, yet the influence of bibliometric indices is already substantial and looks set to increase within the UK HEI sector as the Research Assessment Exercise (RAE) makes way for the new Research Excellence Framework (REF). Here, then, is a guide to some of the more common indices used to rank journals and individuals, explaining how they are calculated, what they do and do not measure, and the games people play trying to outsmart them.

### Ranking journals: To IF and beyond!

Impact Factors (IFs) were devised by Thomson Scientific (formerly Thomson ISI) as a way of measuring how influential journals are, and for some time the annual release of IFs through ISI Web of Knowledge (WoK) have been awaited anxiously by journal editors and publishers. In addition to the impact assessment of journals, IFs are used (not necessarily wisely) for other purposes including advertisement, market research, national-level assessments of scholarship, library decisions on journal subscriptions, comparisons of different scientific fields, evaluation of candidates' publication records by funding or promotion panels, and assessment of the performance of research groups, departments and institutes. So where does this magic number come from? The calculation is actually extremely simple, although the data required are hard to collate – hence Thomson's continued existence as a profitable concern! The IF of a journal is simply the ratio of citations of recent papers to the number of recent papers published. So, the IF for Journal of Applied Ecology (JAP) for the year 2006 is the number of citations in 2006 (across all sources) to papers published in JAP in 2004 and 2005 (996), divided by the number of articles published in JAP in 2004 and 2005 (220), resulting in a healthy IF of 4.53.

I say that JAP's IF is 'healthy', but what does this mean? Well, it compares well with other ecology journals (it ranks 9<sup>th</sup> out of 114), and really, that's about the extent of the reasonable interpretation of the IF. It is essentially meaningless to compare JAP's IF with journals from other fields, where patterns of citation – and in particular, temporal trends in citations – can be very different. This is because IFs only consider 'recent' papers or citations, and the chosen definition of 'recent' (i.e., 'within the last 2 years') is clearly arbitrary. It is probably appropriate for disciplines with a rapid turnover of ideas (e.g. cell biology, neuroscience), less so for those in which impact takes a little longer to become apparent (e.g. ecology, mathematics). This notion of 'turnover' can be quantified using other ISI metrics, including the Immediacy Index, which is a measure of how often papers

are cited within their first year after publication. For instance, JAP has an Immediacy Index (2006) of 0.61, because 71 citations were accrued in 2006 by JAP papers published in 2006, and JAP published 119 papers in 2006 ( $0.61 = 71/119$ ). The assumption seems to be that a high Immediacy Index is a Good Thing (for instance, *Nature's* is 6.79). Other important measures include Journal Cited Half-Life, which is the median age of a journal's articles cited in the current JCR year; and Journal Citing Half-Life, which is the median age of the articles the journal cited in the current JCR year. In other words, half of the citations to the journal are to articles published within the cited half-life, and half of articles cited in the journal are published within its citing half-life. JAP has a cited half-life of 8.4 years, and a citing half-life of 6.7 years. This suggests that JAP – and indeed most ecological journals – operate on a longer timescale than the 2-year window of the IF. This effect is magnified in other disciplines, for example many taxonomic papers continue to be cited >100y after publication, and the half-life of mathematics journals can often be >30y. Given that in all calculations citations from >10y ago are lumped together, it is again clear that these bibliometric indices will be more informative for disciplines with faster rates of publication, citation, and discard of older work.

The IF impacts us as individuals too – the pressure is on to publish in high-impact journals, and CVs are judged accordingly. This is somewhat lazy for two principal reasons. First, the most coveted high-impact journals tend to be multidisciplinary, such as *Nature* (IF = 26.7) and *Science* (IF = 30.0), and it's not clear that all disciplines contribute equally to the IFs of these journals. There is evidence, for example, that the 'impact' of ecological papers appearing in these journals is lower than the journal IF would suggest (although still pretty high for the discipline). This reinforces the view that is often heard among ecologists (not always, admittedly, without bitterness) that one would not necessarily turn to the journal with the highest IF to read the best ecology.

The second reason why journal IFs provide little useful information about individual papers is that they are, by definition, a broad average for the journal as a whole. Within any one journal, the citation pattern of individual papers tends to be very highly skewed: most papers accrue very few citations, but a select few really take off. For instance, in *Nature* just 25% of papers accounted for almost 90% of the citations which counted towards the 2004 IF, and most papers landed fewer than 20 citations. Cameron (2005) eloquently sums it up: 'Publication... in a high-impact factor journal does not mean that an article will be highly cited,

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influential, or high quality'. Given that it's as easy to find out the number of citations to an individual paper as it is to obtain a journal's IF, it seems odd to judge a paper on the journal-level figure which it may possibly exceed (although it probably will not). Perhaps showing how often your papers exceed the impact expected from the IF of the journals in which they appear would be an interesting measure (although it might be a depressing exercise to find out...).

To put it bluntly: *IFs do not measure the impact of papers. They provide a means to compare overall 'impact' of those journals listed in WoK; 'impact' here means specifically the ability of a journal to get its work cited within a two-year window.* But, IFs have gained enormous influence within scientific publishing which seems unlikely to diminish very soon. That said, alternatives are – or may soon be – available to break Thomson's monopoly on bibliometrics. Two of the more promising are Usage Factors and Y-Factors. Usage Factors (unsurprisingly) aim to quantify actual use of papers from a journal, based for example on the number of times the full text of an article is requested or downloaded. Y-factors use citation data, as for IFs, but look at *who* is citing the journal, as well as how often: the Y-factor is derived by multiplying the IF of the journal by the 'prestige' of the citing journals (using algorithms derived by Google to judge the 'prestige' of web pages). More details of these measures are available in the documents referenced below.

### Ranking individuals: keeping your *h* held high

Two obvious measures to rank the scientific productivity of individuals would be the total number of papers published, or the total number of citations accrued. Both will inevitably increase with 'scientific age', however, and favour those who rapidly produce many relatively inconsequential papers over those producing fewer, more profound contributions. To address this issue, in 2005 the physicist Jorge Hirsch published a paper in PNAS, the full abstract of which reads: 'I propose the index *h*, defined as the number of papers with citation number  $\geq h$ , as a useful index to characterize the scientific output of a researcher'. So, your *h*-index is 10 if 10 of your papers have  $\geq 10$  citations, regardless of how many additional, less well cited papers you have. This *h*-index has since generated considerable attention, is routinely cited on CVs etc., and has generated numerous papers extolling its virtues, damning its deficiencies, and proposing modifications and improvements (129 citations and counting...). But, is it any good? Well, according to my favourite *Nature* headline from 2007, 'Hirsch index valuable, says Hirsch'. And broadly speaking, he's right: the most successful scientists tend to have exceptionally high *h*-indices,

although as for IFs what constitutes 'high' varies between disciplines. It's calculation is not without some complications: results can depend on the database used (e.g. Google Scholar can differ from WoK, and different levels of subscription to WoK will uncover different numbers of citations). Also, it relies on picking up all relevant citations (e.g. including those when the work was 'in press', and those in which an author's name, or the journal, or something else, is misspelt or otherwise different from the 'definitive' version). Such 'minority' citations seem likely only to be a major problem when one's *h*-index is either very low (in which case, it's probably not that much effort to trawl manually through all likely candidates) or very high (when you're probably too busy cashing your cheque from Nobel to care that much). In sum, the *h*-index, or some variant, is probably going to be around for a while. Whether decisions over funding or employment will ever be decided on a difference of one or two between candidates' indices remains to be seen (one would hope not), but the take home message is to make sure you publish plenty of highly-cited papers. Simple. Or is there another way...

### Playing the bibliometrics game

Academics typically have the perfect mix of intelligence, paranoia, mischief and computing power to work out very quickly how to extract maximum benefit from the minimum effort by playing the bibliometrics game. IFs, for example, have proved to be susceptible to a remarkable variety of strategies employed by editors. IF depends on the numerator (number of items cited) and the denominator (number of 'citable' articles). Note that an item may be cited without being citable. Editors then may argue with Thomson about what constitutes an 'article' in their journal, typically pushing to have short (but citable, sometimes highly so) news items, editorials and letters excluded from the denominator. This effect is not trivial: the editors of *PLoS Medicine* report a 4-fold difference in the IF of this journal over the course of a single email exchange with Thomson, depending on the definition of an article! Tactics to increase the numerator involve shifting the reference to a paper featured in a 'news and views' piece from the text into a formal reference list (one citation straight away!), a robust degree of self-citation within editorials (leading to some calls to exclude self-citations from the calculation of IFs), and so on. Some publishers may alter their fundamental publishing model in an attempt to chase citations, perhaps moving entirely to open access or, as in the case of the London Mathematical Society's journals, allowing open access for the first 6 months post publication (in an attempt to glean those all-important early citations) before switching back to a subscription-based model thereafter (the opposite of the BES model).

Neither is the *h*-index entirely immune to manipulation: Andy Purvis (2006) amusingly demonstrated how preferentially citing those of your papers that hover just below the *h*-index threshold can be beneficial. Subsequent modelling by Engqvist & Frommen (2008) pours some cold water on this idea, suggesting that the *h*-index is quite robust against excessive self-citation, but one would not bet against tactics being developed and widely employed. Already there are concerns, for instance, that 'citation clubs' are forming, whereby authors preferentially cite allies, rather than the most relevant literature.

### Prognosis: Bibliometric Indices in the future

Bibliometric indices look set to be influencing UK science for some time to come, particularly through the REF. The consultation on this new framework identified many concerns, including reliance on a single commercial data-supplier, the choice of citation window, how to deal with multiple authorship, and the likelihood of increased game-playing. Another challenge will be how to measure the impact and value of publications disseminated through some of the innovative routes identified in Box 3 above. More traditional media cause complications too: one of the most influential ideas in ecology in recent years is surely Hubbell's unified neutral theory of biodiversity, which he published in an old-fashioned book – invisible to many citation metrics. Interestingly, Hubbell's book provides a neat example too of the diversity of ways in which a single work can be cited: incorrect spellings and permutations of name, title etc. have resulted in this single work being cited in more than 60 different ways over the course of its >1100 citations! Finally, bibliometric indices take no account of other ways in which ecologists are useful and productive, including knowledge transfer, conservation and policy work, outreach and communication, mentoring, teaching, editing and reviewing and so on. As was clear from the survey results reported in our *Gender in Ecology* feature (Bulletin 38:4, 2007 – and no, the *Bulletin* doesn't count towards my *h*-index!), BES members strongly feel that these kinds of activities deserve more recognition. So, a plea to those with influence: use bibliometric indices by all means, but be aware of their limitations, and don't fall into the trap of valuing the measurable at the expense of measuring the valuable.

### Further reading

Scientists from many disciplines have understandably been watching the development of bibliometrics with interest and some concern. Here's a selection of the literature most relevant to ecologists. There's also been extensive discussion of these

issues in various journals, so it's worth searching the websites of journals like *Nature* and *PLoS* for editorials and news items too.

*An excellent general critique of the IF is provided by:*

Cameron, B. (2005) Trends in the Usage of ISI Bibliometric Data. *portal: Libraries and the Academy* 5: 105-125

*The REF consultation (including a discussion of bibliometrics) is available at:*

<http://www.hefce.ac.uk/pubs/consult/outcomes/ref.pdf>

*IFs and ecology*

Statzner, B. (1995) Scale effects on Impact Factors of scientific journals – ecology compared to other fields. *Oikos* 72: 440-443

Kokko, H. & W.J. Sutherland (1999) What do impact factors tell us? *TREE* 14: 382-384

Leimu, R. & J. Koricheva (2005) What determines the citation frequency of ecological papers? *TREE* 20: 28-32

Pysek, P. et al. (2006) Who cites who in the invasion zoo: insights from an analysis of the most highly cited papers in invasion ecology. *Preslia* 78: 437-468

Postma E (2007) Inflated Impact Factors? The True Impact of Evolutionary Papers in Non-Evolutionary Journals. *PLoS ONE* 2(10) doi:10.1371/journal.pone.0000999

Krauss, J. (2007) Journal self-citation rates in ecological sciences. *Scientometrics* 73: 79-89

*Alternatives to the IF*

Shepherd, P.T. (2007) *Final Report on the Investigation into the Feasibility of Developing and Implementing Journal Usage Factors*, UK Serials Group, available at: [www.uksg.org/sites/uksg.org/files/FinalReportUsageFactorProject.pdf](http://www.uksg.org/sites/uksg.org/files/FinalReportUsageFactorProject.pdf)

Bollen, J. et al. (2006) Journal Status. *Scientometrics* 69: 669-687, [arxiv.org/abs/cs/06101030](http://arxiv.org/abs/cs/06101030)

Bollen, J. & H. Van de Sompel (2008) Usage Impact Factor: the effects of sample characteristics on usage-based impact metrics. *Journal of the American Society for Information Science and Technology*, 59(1), [arxiv.org/abs/cs/0610154v2](http://arxiv.org/abs/cs/0610154v2)

*The h-index*

Hirsch, J.E. (2005) An index to quantify an individual's scientific research output. *PNAS USA* 102: 16569-16572

Purvis, A. (2006) The *h*-index: playing the numbers game. *TREE* 21: 422

Engqvist, L. & J.G. Frommen (2008) The *h*-index and self-citations. *TREE* 23: 250-252