Low impact factors of ecology journals: don't worry

At the beginning of this century, outstanding scientists influenced both their science and science policy. The diary of Thienemann[1], the co-founder of limnology, provides a vivid documentation of this point. Nowadays, outstanding scientists who influence both their specific discipline and science policy are rare because science and policy have become so complex that few individuals are able to act in both arenas. Consequently, many decision makers in science policy are no longer peers of the scientists they affect, and they lack the competence to evaluate performance on a purely scientific basis. Thus, it is not surprising that decision makers in science policy rely increasingly on mechanical indicators of scientific performance.

The most popular of these mechanical indicators are bibliometric measures; the impact factors (IFs) of scientific journals are the most widely used of these. The IF relates the number of citations of individual articles published in a journal to the number of articles in that journal. IFs appear in the annual Journal Citation Reports (JCR) of the Institute for Scientific Information (ISI); ISI suggests that users can compare a journal's IF, for example, with the baseline (a mixture of different disciplines) for all JCR-indexed journals[2].

However, in addition to the impact assessment of scientific journals, IFs are used for other purposes as well[3]: journal advertisements; publishers' market research; evaluations of the scholarly level of contributions of a country to a field; decisions on financial support for journal publication; decisions by librarians concerning the cancellation of journal subscriptions in times of budget constraints; evaluations of candidates' bibliographies for promotions and professorships; and evaluations of research groups' contributions. Given that literature-based indices have been consulted in establishing university science policy and proposed for use in identifying emerging fields of science, the use of IFs as a consideration in funding research is likely to occur in the future. In contrast to these multiple uses of IFs, the widespread use of publication counts has been blamed for the deluge of trivial publications, and for encouraging the trendiest science rather than the best. More disturbingly, it has led the public to assume that most scientific research and publications are a waste of money, and has even prompted (US) law makers to reduce science funding[3].

Despite this ongoing debate on the use of IFs, ecologists have to face an increasing use of IFs in evaluations of scientific performance. For example, Peters[4] used low values of IFs as evidence of the crisis state of research in ecology given the high IFs indicative of the current power in other fields (biochemistry and molecular biology). Therefore, we examined how IFs are affected by characteristics related to ecology by comparing impact values of scientific journals in ecology to those of other fields[3]. We suspected that IFs should be influenced by scale effects in space (i.e. size of the literature in a field) and time (i.e. the length of time to conduct subsequent research after a seminal article appears) because IFs indicate frequencies with which the 'average article in a journal has been cited in a particular year, and is calculated by dividing the number of all citations of articles published in a particular journal during the previous two years by the number of articles published in that journal in those two years'[2]. Therefore, the IFs of journals leading each subject category should depend on the total number of annual publications in that category because the probability that an article in the top journal is cited increases with the total number of annual publications in its category. Moreover, because of the relatively recent period considered in the calculation of IFs (2 yrs), the time required to work with specific methods of a subject category will affect the IFs.

For example, 'Ecology' and its subset 'Freshwater Ecology' (a category we generated from various JCR categories) represent two disciplines with relatively low impact factors (top journals: IF ≈ 2–4), have negligible automated data collection, and articles are often based on several years of field research. The main difference between these categories is in their total number of annual publications ('Ecology' ≈ 4300; 'Freshwater Ecology' ≈ 2500). In contrast, 'Biochemistry & Molecular Biology' represents a JCR category with high impact factors (top journals: IF ≈ 30), higher numbers of annual publications (≈ 30 000), and laboratory-based methods that are increasingly automated.

Depending on the scale considered, the ranking of journals based on impact values from these categories changes dramatically. For example, on the scale of a long-term, relative impact factor (total number of citations to a journal in 1992 divided by its mean number of annual publications in the years 1990 to 1992, then divided by the total number of annual publications per subject category), a journal like *Cell* (traditional IF: 33.6) has a value of 0.0074. On this scale, ecology journals rank as well as or higher than *Cell*; for example, *Freshwater Biology* (traditional IF: 1.2) has the same impact, *Ecology* (2.6) almost double impact and *Ecological Monographs* (3.6) fourfold impact. Compared to these traditional ecology journals, the journal publishing this 'Postscript' has a different editorial policy. *TREE* is not a journal for the publication of original results. Instead, authors are encouraged to perceive their role as reporters, chroniclers and commentators. Therefore, in the 'Ecology' category, *TREE* has a relatively high traditional IF (2.9) but a lower long-term, relative impact factor (about 25% of that of *Ecology*, which may be partly caused by the more recent appearance of *TREE*). Clearly, methodological approaches that are automated and laboratory-based (such as in 'Biochemistry & Molecular Biology') compared with time-consuming and often field-based ones (such as in 'Ecology' and 'Freshwater Ecology'), along with numbers of publications in a field, greatly skew IFs. Thus, IFs of journals in ecology are no better or worse than those in other fields; they simply reflect the scale characteristics of ecology. Consequently, ecologists shouldn't worry about the IFs of their science; instead, they should worry about how to convince decision makers in science policy why ecology has less impact on the JCR scale currently used as a mechanical indicator of scientific performance.

Acknowledgements

This is an abridged version of an article[3] in *Oikos*. We gratefully acknowledge *Oikos*' permission to summarize it here.

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