

bear fruit, but believing that those will likely have a major impact once they become accepted in the mainstream. So, for us, 'quality' has to do with methodological issues and not with immediate factual correctness: Does the presented evidence come from sources that are not obviously unreliable? If experiments were performed, were protocols and controls appropriate? Does the discussion of the possible import of the evidence respect principles of logic and consistency?

The primary, perhaps only, safeguard of quality is the day-to-day decision-making by the editor(s). If a journal's explicit policies are to be realized in practice, not only the editors but also the manuscript reviewers must deliberately abide by them. An editor's responsibility is, first of all, to make a good choice of reviewers, people with relevant competence and who are likely to judge the validity of the evidence and the soundness of the discussion without being unduly prejudiced by their own prior beliefs. That is no mean task, for none of us can be entirely free of bias toward what we believe to know. Moreover, as the popular aphorism has it, a totally open mind would let the brain fall out; or, as Chesterton (1936) understood, an open mind has the same function as an open mouth, namely to shut itself again on something solid. So, every potential reviewer who knows *anything* will, thereby, have a bias against *something*, and any potential reviewer who has no biases is likely to be lacking in relevant knowledge.

Therefore, an editor's responsibility to exercise judgment begins rather than ends with the choice of reviewers. There is, after all, no law that reviewers' judgments must be accepted. Many of us have in our files copious illustrations that editors should have overruled reviewers who got their facts wrong, or who offered their own interpretations as the only legitimate ones, or who vented personal spleen, and so on. If an editor lets reviewers get away with such unwarranted critiques, then that represents a low quality of editorial performance. Authors of papers have a right to expect that reviewers should be held to the same standards of sound knowledge and valid logic as is expected of the authors of manuscripts. It is an editor's responsibility to hold all concerned to those standards.

The rules of the game in science publishing

Howard I. Browman

(Contributing Editor, *Marine Ecology Progress Series*)

Institute of Marine Research - Austevoll, 5392 Storebø, Norway

Email: howard.browman@imr.no

In the game of communicating science, it is routinely assumed that players know both the overall rules of the

game, and the rules specific to the position(s) that they are playing. I herein assert that this false assumption underlies many of the problems associated with achieving and maintaining quality in science publishing.

All of my professional experience leads me to the uncomfortable conclusion that too few of our colleagues have received explicit and thorough instruction in their roles as authors, peer reviewers, arbitrators, or editors. In July 1983, Brian Marcotte (my Masters advisor) asked me to assist him in assessing a manuscript that he had received for review. Using that manuscript, and several others that arrived thereafter, Brian patiently and conscientiously instructed me in my role as a reviewer, and 'peer reviewed' my peer reviews. He also spent a great deal of time and effort teaching me about scientific writing, the preparation of illustrations, and the critical choice of which scholarly outlet was best suited to an article's subject matter. This anecdote illustrates that, for each and every position that we play in the game of science publishing, achieving the highest degree of skill requires intense training from a competent and experienced mentor. We must also recognize that, just because we can play one of the game's positions with great skill, does not mean that we can play all of them equally well. At least not without training anew, each time a new position is taken up. Further, the skills required to produce a quality product, or to assess the product's quality, must be continually upgraded and honed, throughout our careers. Complacency and quality are incompatible.

In addition, in order to assure an even playing field, we must all conduct ourselves according to an explicit, easily accessible, widely accepted and routinely taught 'rules of the game'. For many reasons—which are beyond the scope of this TS—the degree to which we achieve all of this is limited, and highly variable. Following from this, the enormous range in the level of competence that we all encounter during the process of publishing articles in the scientific literature should come as no surprise.

A more insidious contributor to the uneven level of competence exhibited at all 'positions' in the publishing game is the ubiquitous psychological phenomenon of being 'unskilled and unaware of it' (sensu Kruger & Dunning 1999, Dunning et al. 2003, Edwards et al. 2003). To a highly variable extent, we all carry what Kruger & Dunning (1999) refer to as 'the dual burden': the very fact that we are unskilled at some task (and/or incompletely aware of the rules) leaves us unable to realistically judge both our own performances, and those of others. In the context of the preceding paragraphs, sufferance under this dual burden may most often reflect only that the players on the team are poorly trained. Several contributors to this TS recount

anecdotes that are fully consistent with these contentions; how an author, a reviewer, or an editor did not seem to know (or at least did not do) their job. I have no doubt that everyone who reads this would be able to contribute their own such anecdote(s).

In an attempt to bolster the assertions laid down above, I conducted an informal survey of colleagues who have been editors or editorial board members of aquatic science journals. I asked if they were familiar with the details of the Editorial Policy Statements approved by the Board of Directors of the Council of Science Editors (CSE; www.councilscienceeditors.org). I also asked if these guidelines had been formally and explicitly discussed with them at the time that they were recruited as editors. The majority had never been members of the CSE, and some were unaware of its existence. Only a minority were familiar with the material in the CSE guidelines, and/or had openly discussed such issues prior to putting on the editor's cap. While this is clearly not a 'scientific' poll (I admit to being an unskilled poll taker), it is instructively and disturbingly consistent with the assertions made above. I contend that the results would be similar if an analogous survey were conducted of authors and reviewers.

We *can* take steps to improve the situation. As a start, everyone involved in publishing science, and particularly those mentoring students, should familiarize themselves with the guidelines for authors, reviewers, and editors set out by the CSE. The CSE also makes available, and/or recommends, instructional resources for authors, reviewers and editors. Several of the contributions to this TS make thoughtful suggestions along these lines, as has Otto Kinne (1988). We can also all take it upon ourselves to more routinely discuss with our students and colleagues the fundamental nature of the various roles in science publishing, and the ethics surrounding each. The CSE takes up many of these. On a more specific and case-by-case basis, each of us can, and should, make it clear to authors, reviewers and editors when they have clearly not exhibited an appropriate level of skill, or have engaged in unsportsmanlike conduct. Editors can routinely make reviewers aware of the weaknesses and strengths of their critiques by sending all of the reviews of a given manuscript (and the basis for the decision on the manuscript's fate) to everyone involved, and not only to the authors. The manner in which this is done should always be constructive. Finally, the team's players should never be overworked, as this can only result in poorer play.

The highest standard of quality in science publishing can only be achieved when every member of the team knows their role and plays it with experience, skill, and dedication.

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Achieving and maintaining quality in scientific publishing

Bruce P. Dancik (Editor-in-Chief, National Research Council of Canada Research Press)

Department of Renewable Resources, University of Alberta,
751 General Services Building, Edmonton, Alberta T6G 2H1,
Canada

Email: bruce.dancik@ualberta.ca

Some of what we see published in scientific journals is of excellent quality, is widely read and highly cited, and proves valuable for years or decades after it is published. A lot more, however, while reporting on sound and carefully conducted experiments, is not read by many scientists, ends up rarely being cited by others, and is soon forgotten. What is the difference between these types of papers? What can editors do to identify important, citable submissions? What is the role of all the participants in the publishing process to help ensure that a journal publishes only the best manuscripts?

There are no easy answers to these questions, but there are a lot of things editors and publishers can do to improve the quality of their journals. These range from things that can be done to attract the very best manuscripts from the best scientists to the procedures that are used to vet those manuscripts, make the best decisions, and provide authors with the best service possible.

Publishers. What can the publisher do to help his journal and editor attract the best papers? Publishers can ensure that they put out a quality product in a timely fashion. Authors look for and expect journals to come out when they say they will; they have little patience with journals whose issues are frequently late. Similarly, authors expect that their manuscripts will appear well copy-edited and proofread, with attractively laid out figures and tables, in an attractive finished product, whether that is a hard-copy journal or an electronic journal. Readers, who, after all, are potential authors for the journal, expect to find well written and edited text, useful supplementary material, all put together in an attractive package that makes up each issue of the journal. They don't have patience with inaccurate citations in a paper's literature cited, and they find it frustrating and time-consuming to correct mistakes while they are reading.