

Publication and Rejection among Successful Ecologists

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Scientific rejection is a frequent part of the publication process that is rarely explicitly discussed. Peer review is an essential and well-established part of the scientific method. But to what degree is manuscript rejection indicative of scientific inadequacy? Here we quantify the extent to which a sample of scientists with successful publication careers in our discipline, ecology, have experienced manuscript rejection. We show that publication success and manuscript rejection are definitely not exclusive. Notably, we find that the ecologists with the highest number of publications also suffered the largest proportion of manuscript rejections. Rejection is not easy even for the most successfully publishing ecologists; however, manuscript rejection does not seem to have deterred our respondents or to have hampered their career advancement. We hope that our results will encourage ecologists (and particularly research students) to continue submitting their studies for publication.

Keywords: ecologists, publication success, rejection rate, questionnaire, survey

One of the standard metrics by which scientists are judged is the rate at which they publish papers in peer-reviewed academic journals. This can create fierce competition for page space in these journals, with the result that most journals can publish only a fraction of the manuscript submissions they receive. That fraction may be quite low, even for specialist journals. For example, according to letters sent from the editor to referees, the *Journal of Animal Ecology* typically can publish only 25 percent of the articles submitted to it. A corollary of the disparity between the number of articles received and the number published by journals is that many manuscripts are rejected. Manuscripts may report perfectly competent science on a subject appropriate for the journal but still be rejected, if the referees or editors consider them unlikely to be of sufficient interest to readers.

Peer review is a well-established step on the route to scientific publication, but the rejections that it inevitably engenders can be daunting and disheartening, especially for young researchers and graduate students. Although it is clear that rejection must be a significant part of the scientific process, it is a part that, in our experience, is rarely explicitly discussed (but see Pannell 2002). Having a manuscript rejected, particularly when the rejection comes early in a scientific career, can be perceived as an indication of a lack of quality or ability in the chosen field of research. Although in some instances that may indeed be the case, it is clear that a number of competent manuscripts are rejected because of a lack of space in the chosen journal. Some manuscripts may also be rejected because of failures in the peer-review process, or because their content is simply not understood or appre-

ciated by the referees (see, e.g., Cole et al. 1981, Wennarås and Wold 1997, Bonnet et al. 2002, Gura 2002, Pannell 2002, Trenzga 2002). It is difficult to judge the extent to which manuscript rejection is a characteristic of a failing career, because the rate of rejection experienced by successful and senior scientists is unknown.

Here we report the results of a survey we conducted to reveal the extent to which rejection is encountered by scientists in the field of ecology. Our aim was to quantify failure rates among scientists who, by most metrics, would be considered to have successful careers. Since the publication rate is a commonly used measure of scientific success, we used the frequency with which these scientists had articles declined by journals as our measure of rejection. In addition, we were interested in answering the following questions: First, is rejection rate related to career success? Second, what do authors perceive to be the reason for rejection of their articles? Third, do scientists believe it is getting harder to publish their work? We show that even the most successful scientists have considerable experience of rejection. A brief summary of some of these results is also given by Cassey and Blackburn (2003).

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A survey of successful ecologists

To identify scientists to consult, we assembled a list of all authors of articles in five leading ecological journals (*The American Naturalist*, *Ecology*, *Journal of Animal Ecology*, *Journal of Ecology*, and *Oikos*) for the decade 1990–1999. This list reveals that ecological research during this period was dominated by a large number of scientists with few publications (figure 1). Out of a total of 7863 authors, only 155 had at least 10 publications in these five journals during the 1990s, but these authors' publications constituted 19 percent of all the articles published in those journals (Cassey and Blackburn 2003). We used these 155 authors as our sample of successful scientists in the field of ecology. We note, however, that this is only one possible metric and in no way suggests that to be a successful ecologist you are required to publish in all (or any) of these journals.

We circulated a simple one-page questionnaire to quantify the rejections experienced by these authors (we could not obtain valid addresses for 4, resulting in a total of 151 questionnaires posted). The survey was first sent by post in October 2002 and then followed up by an e-mail reminder 4 months later, in February 2003. A short questionnaire, designed to be completed in about 15 minutes, requested information on the numbers of manuscripts rejected and the perceived reasons for the rejections, as well as basic background data on the academic position and publication career of the respondents. (The questionnaire may be viewed online at www.snv.jussieu.fr/minus/eem/papers/Questionnaire.pdf.)

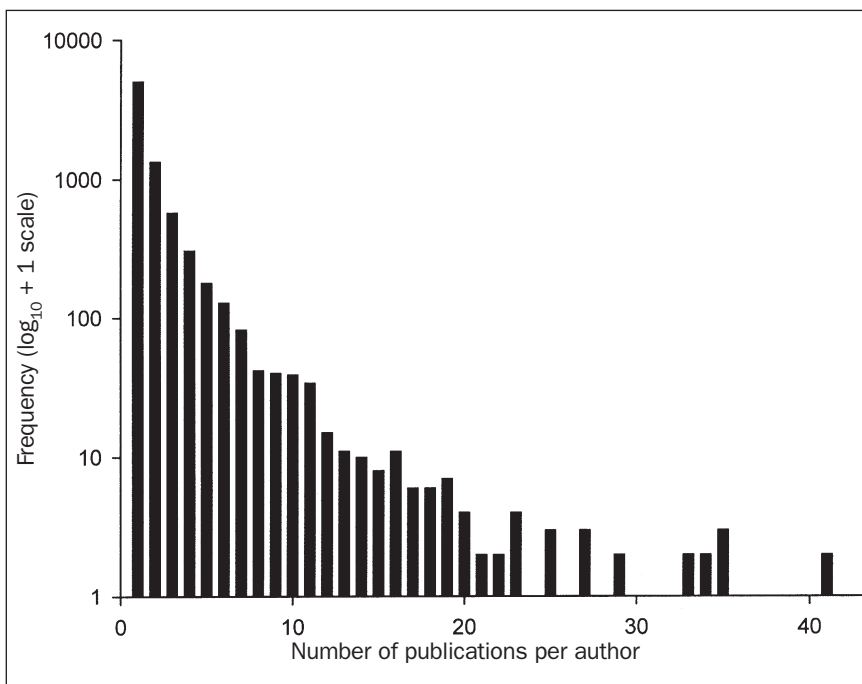


Figure 1. Distribution of the frequency (\log_{10}) of the number of authors with publications in five leading specialist ecological journals (*The American Naturalist*, *Ecology*, *Journal of Animal Ecology*, *Journal of Ecology*, and *Oikos*) for the decade 1990–1999.

Response bias. We used three characteristics of the ecologists polled to test for evidence of response bias. First, we tested whether or not a response was dependent on the number of articles the surveyed authors had published in the five journals during the 1990s. Second, we tested whether gender was a significant predictor of response. Third, we tested for evidence of response bias in terms of the geographic region in which the respondent lived.

Statistical analyses. Data from the completed questionnaires were analyzed using SAS version 8.02. We used generalized linear models (McCullagh and Nelder 1990) to examine the relationship between the logistic response variable (proportion of papers accepted) and the predictor variables obtained from the survey. Ordinary least squares regression was used to analyze the relationship between the predictor variables and the response variable “years since PhD was awarded.” Contingency tests were used to test for significant nonresponse biases attributable to gender and biogeographic region, and a Wilcoxon two-sample test was used to test for response bias in number of publications.

Results of the survey

Of the 151 ecology research authors for whom we were able to obtain addresses, we received valid responses from only 61 (40.4 percent). Of our respondents, 7 are emeritus professors or retired, 41 are full professors or chairs, and 13 are lecturers or tenured researchers. The number of publications by authors who responded (mean number of publications \pm standard deviation [sd] = 15.96 ± 7.81) was not significantly different from that of those who did not respond (mean \pm sd = 13.34 ± 3.84 ; Wilcoxon two-sample test, $Z = 1.51$, $n = 151$, $P = 0.13$; Cassey and Blackburn 2003). There was a highly detectable bias in the gender of the ecologists polled, as only 9 of these 151 authors (6.0 percent) were female. However, there was no significant gender difference between the authors who responded and those who did not ($\chi^2 = 1.31$, degrees of freedom [df] = 1, $P = 0.25$; Cassey and Blackburn 2003).

More than half of the authors (52.9 percent) had addresses in North or Central America (Canada, United States, and Panama); 17.2 percent had addresses in the United Kingdom (England and Scotland); 25.8 percent had addresses in the remainder of Europe (Belgium, Denmark, Finland, France, Netherlands, Norway, Poland, Spain, Sweden, and Switzerland); and 4.0 percent had addresses in Australasia (Australia and New Zealand). Although Australasia had more than twice the response rate of any other geographic region, there

was nevertheless no significant relationship between response rate and region ($\chi^2 = 4.97$, $df = 3$, $P = 0.17$; Cassey and Blackburn 2003). The probability of a response was the same for the other three geographic regions ($\chi^2 = 0.98$, $df = 2$, $P = 0.81$).

Respondents published a total of 2907 scientific papers in journals during the decade 1990–1999, of which 450 (15.5 percent) had been rejected by at least one journal and 224 (7.7 percent) by at least two (Cassey and Blackburn 2003). The average number of research articles that an individual author published in the 1990s was 55, with one author publishing the maximum amount of 250. Figure 2 shows the percentage of articles that were published at first submission, at second submission, and after multiple submissions during this decade. On average, 22 percent of a respondent's articles were rejected at least once (Cassey and Blackburn 2003). Only one respondent claimed that none of the 14 articles he published in the 1990s was first rejected and then subsequently accepted (and even this scientist still had at least one article that remained unpublished from that period). Responding authors had on average 2 articles still unpublished after this period, with one author having 10.

Respondents who published more articles in the 1990s had a lower percentage of published articles that were accepted without being rejected at least once (coefficient [coeff] = -0.75 , standard error [SE] = 0.15 , $P < 0.01$; Cassey and Blackburn 2003) and a higher total number of articles from the 1990s that remained unpublished (coeff = 0.59 , SE = 0.26 , $P = 0.03$). Those who were full professors at the time of the survey had a lower percentage of articles accepted without being rejected at least once (77 percent) than those who were tenured researchers (87 percent) or emeritus professors and retired researchers (85 percent) (coeff = -0.39 , SE = 0.17 ,

$P = 0.02$). Full professors also had a higher percentage of articles submitted multiple times before acceptance (coeff = 0.45 , SE = 0.21 , $P = 0.04$).

The authors' total numbers of published articles did not affect their opinions as to why their articles were rejected ($F_{3,55} = 0.49$, $P = 0.69$). However, there was an association between the authors' opinions as to why their articles were rejected and the percentage of their articles that were accepted without rejection, rejected once and then published, or rejected multiple times before publication (table 1). Respondents with a higher percentage of articles accepted without rejection were of the opinion that the rejections they did experience were attributable to scientific grounds, whereas respondents with a lower percentage of articles accepted without rejection were more likely to blame poor refereeing or editorial processes ($\chi^2 = 25.07$, $df = 1$, $P < 0.001$; Cassey and Blackburn 2003).

Of the respondents, 35 percent thought it was harder for them in particular to publish articles in 2002 than in 1990, compared with only 15 percent who thought it was easier, while 50 percent noted no change. The percentages were the same for the respondents' opinions on the difficulty of publishing for all ecologists ($\chi^2 = 1.99$, $df = 1$, $P = 0.57$). Publishing was more likely to be considered harder by respondents who had a smaller percentage of articles accepted without rejection ($\chi^2 = 19.12$, $df = 1$, $P < 0.001$) and by respondents who had a greater percentage of articles submitted multiple times before publication ($\chi^2 = 22.83$, $df = 1$, $P < 0.001$; Cassey and Blackburn 2003).

The mean year that respondents received their PhD was 1979, and the median and mode were 1980. The earliest and most recent degrees were 1961 and 1993, respectively. The year in which a respondent's PhD was awarded is, unsurprisingly, negatively associated with the career position of the respondent (table 2). The more recently a researcher received a PhD, the lower the percentage of that researcher's articles that were accepted without rejection (coeff = -0.05 , SE = 0.01 , $P < 0.01$).

In addition, the more recent the respondent's PhD, the greater the number of the respondent's articles that remained unpublished from the 1990s ($r = 0.38$, $n = 61$, $P = 0.03$).

The number of articles the respondents published with their PhD supervisors after receiving their PhD was positively associated with the percentage of articles that were accepted without rejection (coeff = 0.03 , SE = 0.01 , $P < 0.01$). However, the

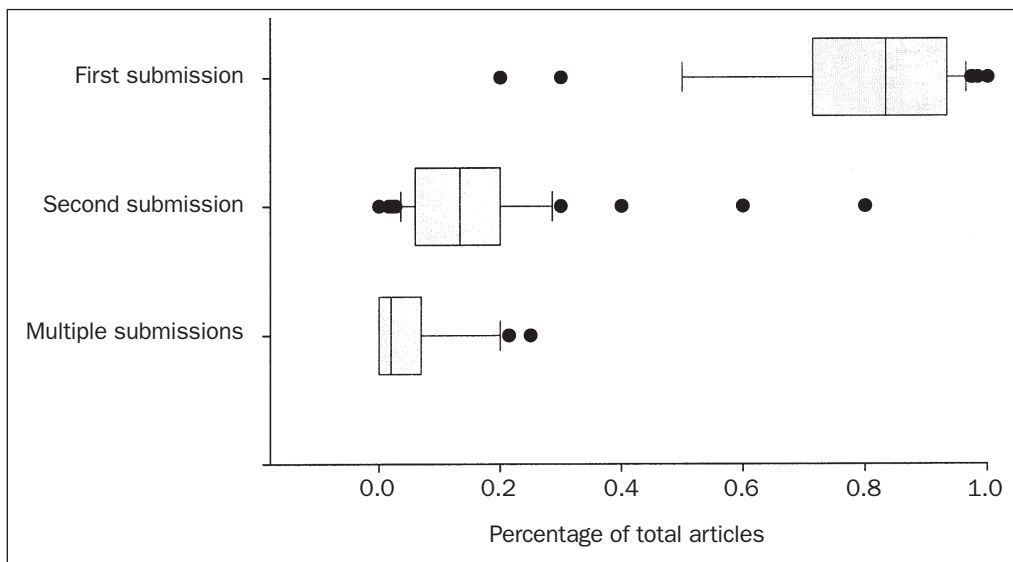


Figure 2. Percentage of total research articles published by survey respondents on first submission, on second submission, and after multiple submissions during the decade 1990–1999 (Cassey and Blackburn 2003).

Table 1. Relationship of response variable to respondent's opinion of reason for rejection.

Response variable	Category for rejection	Parameter estimate	F-statistic
Accepted without rejection	Scientific grounds	0.57	31.36***
	Importance to editor	0.51	
	Poor referee/editorial process	0	
Rejected once	Scientific grounds	-0.42	10.57**
	Importance to editor	-0.30	
	Poor referee/editorial process	0	
Rejected multiple times	Scientific grounds	-0.75	30.71***
	Importance to editor	-0.81	
	Poor referee/editorial process	0	

P < 0.01; *P < 0.001.

Note: Three univariate generalized linear models were used to test whether the logistic response variable (the proportion of a respondent's articles that were accepted without rejection, accepted after one rejection, or accepted after multiple rejections) was related to the respondent's opinion of why his or her articles were rejected. Positive parameter estimates indicate that larger values of the category for rejection are associated with a higher percentage of articles accepted without rejection. For all three variables, parameter estimates are calculated relative to the category "poor referee/editorial process."

significance of this result relies on a single author who published 38 articles with his supervisor after receiving his PhD (figure 3), resulting in a distribution that is highly skewed to the right. If this outlying author is removed from the data, the relationship is not significant (coeff = 0.02, SE = 0.01, $P = 0.23$). After receiving a PhD, more than half the authors (56 percent) subsequently never published with their supervisor.

Implications for publication of ecological studies

Rejection is a fact of life for scientists (Cassey and Blackburn 2003). We have shown that even ecological scientists with successful careers experience rejection, in terms of having their articles declined for publication by at least one journal. Indeed, successful ecologists can expect that, on average, more than one-fifth of their articles will be rejected on the first time around. Most (72 percent) have at least one article that they have not been able to publish.

Our primary aim in conducting this survey was to reveal to young researchers, and researchers early in their careers, the extent to which successful scientists experience rejection. Our hope was that the realization that all ecologists suffer setbacks when trying to publish would be of some reassurance during initial exposure to the peer-review process (see also Pannell 2002). Two findings seem particularly comforting in this regard. First, the more articles successful scientists publish, the higher the percentage of rejections they receive. Second, full professors have had a higher percentage of articles rejected at least once (23 percent) than have scientists at the earlier career stage of lecturer or tenured researcher (13 percent). Thus, rejection does not seem to have hampered career advancement among our respondents or to have deterred them from their career path.

One obvious criticism of our survey is that we only polled the views of scientists who clearly have had successful careers. Of our respondents, 70 percent currently have the title of full professor. The rejection rates we report here may therefore be highly biased, and these rates may be much higher among those scientists who abandon the field of ecology (at least in

Table 2. Relationship of response variable to respondent's career level.

Career level	Year PhD awarded	Standard error
Retired or emeritus professor	1967	3.46
Full professor	1979	0.96
Tenured researcher	1987	1.54

Note: Tukey-Kramer multiple comparisons test (Zar 1999). F -statistic = 14.13; $P < 0.01$. A generalized linear model was used to test whether the response variable, the year in which the PhD was awarded, was related to the respondent's career level. The differences in the career levels obtained in relation to the year that the PhD was awarded are all significant.

an academic setting) at an early stage in their careers. This criticism may well be correct. We have no data with which to assess rejection rates among ecologists whose careers have failed. Moreover, such data would be hard to come by, as unsuccessful ecologists would be very difficult to contact once they left academia. Nevertheless, we suspect that most journals probably reject more than 20 percent of the articles submitted to them, which would imply that the rejection rate at first submission across all ecologists is likely to be higher than the 22 percent we found among our respondents. However, this criticism does not invalidate our study. Our aim was not to provide an unbiased estimate of rejection rates across the entire discipline of ecology, but rather to show the frequency with which even successful scientists have articles declined by journals.

That said, there is no evidence from our data that the respondents represent a biased set of the ecologists we polled. Although respondents tended on average to be male, to have addresses in Australasia, and to have published more articles in the 1990s in the five journals used in our sample, none of these tendencies were significant. One obvious bias in our data, however, is that the vast majority of scientists out of the 151 polled were male. Indeed, only 6 percent were female, significantly less than the approximately 50 percent that might be expected to be successful if the discipline of ecology were

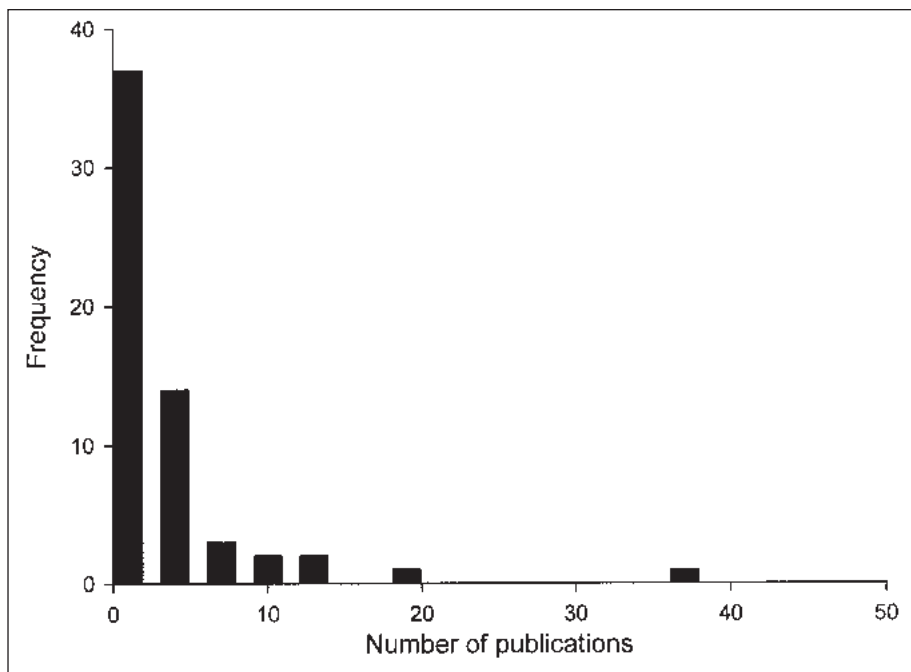


Figure 3. Relationship between the frequency of an author's publications and the number of articles published with the author's PhD supervisor after receiving the degree.

unbiased with respect to gender. The gender bias among senior academics is a well-known phenomenon (Wennerås and Wold 1997, 2000, NSF 1999), but its degree in our survey is nonetheless arresting.

Respondents to our survey tended to concur with the opinion of this article's second author (T. M. B.) that it was harder to get manuscripts accepted by journals in 2002 than it was in 1990. Only 15 percent of the respondents thought it had become easier to publish; more than twice as many (35 percent) thought it had become more difficult. This fits in with the generally higher levels of competition for journal space resulting from such procedures as the British Research Assessment Exercise, which assesses the quality of university departments in part on the basis of the number (and quality) of their staff's scientific publications. However, somewhat surprisingly, 50 percent of respondents thought that there had been no change in the difficulty of getting published. One possible reason for this result is that any increase in the difficulty of publishing between 1990 and 2002 may be balanced, for the scientists polled, by increases in their familiarity with the publication process, in their reputation, or in the quality of their submitted work. All of these may improve the probability of an author's getting articles accepted relative to those ecologists who were not polled. In addition, more than a third of the respondents (36 percent) noted that there had been a proliferation of journals publishing ecological science since 1990. Authors may improve their chances of publication by submitting to these new journals, which, initially at least (until their citation index is established), may receive relatively fewer submissions.

Our data do provide one piece of evidence that suggests it could be getting harder to publish scientific articles. There is a negative relationship between the date that respondents had their PhD awarded and the percentage of their articles that were accepted without rejection: The later the award, the lower the percentage. Assuming that respondents with later PhD dates published more of their articles toward the end of the 1990s than respondents with doctorates awarded earlier, this result is consistent with decreased ease of publishing through the 1990s. However, even if this assumption is correct, there remains at least one alternative interpretation for this result. Respondents with later PhDs are earlier in their careers, and so there could still be a few career failures waiting to happen in this set of scientists. In contrast, all failures will already have happened by the time scientists reach the most senior positions. We think this latter interpretation is unlikely. All respondents

are in lecturing positions at least, and most are already full professors. This can be judged a successful career in ecology, in our opinion, and relatively few scientists will abandon an academic career from this point. Moreover, the rejection rate at first submission among tenured researchers is actually lower than that among full professors. Finally, the most recently awarded PhD among our respondents was 1993, yet all respondents were still in scientific posts a decade beyond that point. It seems likely that these are career ecologists, and that career failure would probably have happened already if it were going to happen at all (despite the constant fears of the second author of this article).

Our survey provides little evidence of the benefits of publishing with one's PhD supervisor after receiving a doctoral degree. The mean number of articles that respondents published with their supervisor after finishing their PhD was 2.8 (SD = 5.8), or 2.2 (SD = 3.5) when the outlying ecologist who published 38 (figure 3) was removed. It is interesting that so many of these scientists have advanced to the top of their field without a further collaborative academic relationship with their supervisor. One author took the time to note that his supervisor "did not even read [the] dissertation." Young researchers and graduate students need to be aware that, while a good working relationship with a supervisor should always be encouraged, it seems from our respondents that it is neither necessary nor advantageous for a successful publishing career. We imagine that this finding, like our finding that rejection is not incompatible with success, will be of great comfort to a number of ecologists early in their careers.

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