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THE USEFULNESS OF IMPACT FACTORS IN SERIAL SELECTION: A RANK AND MEAN ANALYSIS USING ECOLOGY JOURNALS

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Abstract—*This paper investigates the usefulness of ISI Journal Impact Factors in making serial selection and deselection decisions. It shows that Impact Factors do not remain relatively constant from year to year; specifically, the rank order of 56 ecology titles was found to vary considerably over time. The median year-to-year variation in Impact Factors was found to be 21.9%, and the average variability of Impact Factors over a five-year period was 13.2%. The study also found a considerable degree of overlap in the average Impact Factor of serials in the ISI's Ecology category. These findings cast doubt on the usefulness of relying on a single year's JCR (Journal Citation Reports) to make informed selection/deselection decisions.* © *1998 Elsevier Science Ltd*

INTRODUCTION

In the 25 years since Garfield introduced his concept that the worth of a serial could be measured by the average citation frequency of articles published in the serial (that is, Impact Factors), many information professionals have employed this methodology to make decisions with regard to serial selection and deselection [1]. Publishers, too, have relied on Garfield's concept, promoting their

TABLE 1
Sample Change in Impact Factor

	1994	1995	95/94 95/94	% Change	Relative % Change Highest/Lowest
Serial A	1	1.25	1.25	125	25
Serial B	1	0.50	0.50	200	100

titles on the grounds that they have higher Impact Factors than those of their competitors and suggesting that librarians might prefer to subscribe to titles on this basis [2].

Most persistently advocated in the literature has been the view that journal titles with high cost in relation to Impact Factor would be candidates for cancellation or deselection, while titles with a low cost in relation to Impact Factor would be candidates for retention or selection [3]. Stankus has carried this view to its logical conclusion by using the Relative Impact Factor in the decision-making process for selecting and deselecting serials in particular subject areas [4]. He defined Relative Impact Factor by expressing the serial's JCR Impact Factor as a percentage of the JCR Impact Factor of the leading serial in that discipline (JCR being the ISI's *Science Citation Index Journal Citation Reports*). Thus the lower the Relative Impact Factor, the less frequently the average article in a specific journal was cited. Stankus also has advocated that librarians consult JCR to determine which serial in each discipline has the highest Impact Factor; using the JCR-cited journal package, the librarian should determine the serials most frequently "Cited By the Leading Journal" (CBLJ) [5]. Then, after determining the Relative Impact Factors and subscription costs of the CBLJ serials, the librarian could decide which titles to select or deselect.

If Impact Factors are to have a legitimate role in the decision-making process, then they should be relatively stable over time for a given set of titles; otherwise the selection of titles for subscription would vary from year to year, depending on the ranking of the Impact Factors of each title. In terms of consistency in collection development, the consequences are obvious—a subscription would be maintained only as long as a title's Impact Factor remained high, being cancelled and reinstated in accordance with fluctuations in the annual Impact Factor.

The question then becomes this: How volatile are Impact Factors? This report investigates the degree of volatility of the Impact Factors of a group of serials in order to determine whether reliable selection decisions can be based on a single set of Impact Factors. It follows the work of several other investigators who have questioned the value of relying on Impact Factors in place of local use studies when making collection development decisions [6].

METHODOLOGY

The JCR for 1991 through 1995 were used to compile the Impact Factors of serials in the field of Ecology, selected as a typical scientific discipline. Means and standard errors in the Impact Factors for each title were determined using Microsoft Excel. The standard error for each title was also expressed as a percentage of the title's mean Impact Factor. The year-to-year change in each serial's Impact Factor was transformed as the percentage of change in Impact Factor relative to the lower Impact Factor; Table 1 presents an example of such a transformation. This table indicates that between 1994 and 1995 there was a 25% increase in Impact Factor for Serial A, while in the same period there was a 50% reduction in Impact Factor for Serial B. Because the maximum percentage of reduction in Impact Factor can be 100% (e.g., 1 in 1994, 0.00 in 1995, or 100% decrease) and the maximum percentage of increase in Impact Factor is open-ended (e.g., 1 in 1994, 4.6 in 1995, or 460% increase), it was decided to transform the percentage of change in Impact Factor from one year to the next using the lowest Impact Factor as the starting point. When this is done, the relative percentage of change for Serial B is 100%, while that for Serial A remains at 25%.

SigmaStat for Windows (Jandel Corporation) was used to apply the Mann-Whitney Rank Sum Test (or *t* test) to investigate whether there was a statistically significant difference in the Impact Factors of two titles. Regression coefficients between the level of use and Impact Factors were determined using SigmaPlot for Windows (Jandel Corporation). Ebsco's *Librarians' Handbook 1996–97* was used to determine the Australian dollar cost of Ecology serials.

Appendix Table 1A displays annual Impact Factors of the 73 Ecology serials listed in JCR for 1991–95. It also lists the mean, standard error (SE), and standard error expressed as a percentage (%) of the mean of each Ecology serial listed in JCR. Using the *Australian Journal of Ecology* (ranked 23rd in 1995) as an example, Table 1A indicates that this serial's Impact Factor declined from 1.132 in 1991 to a low of 0.806 in 1993 before increasing to 1.545 in 1995. The mean Impact Factor for this journal over the period 1991–95 was 1.176 $\pm$ 0.1217 SE. This Standard Error corresponds to a 10.89% variation in the mean Impact Factor of the *Australian Journal of Ecology*. The final column in Table 1A ("*t* test") shows the results of the *t* test comparison of Impact Factors of each serial with those of the *Australian Journal of Ecology*. All *t* tests were performed using SigmaStat for Windows (Jandel Corporation).

ANALYSIS OF THE DATA

If JCR tables of Impact Factors are to be useful in the selection of one serial over another, then the relative ranking of titles should not vary greatly from year to year. Any analysis of the variation in the ranking of Ecology serials is complicated by the fact that not all 73 titles have Impact Factor data for the entire period. For instance, during 1991–95 14 new titles were added, while the *Journal of the North American Benthological Society* was only intermittently included in JCR [7]. Titles with incomplete data for this period have a differential effect on the ranking of serials; this must be corrected prior to establishing whether the relative ranking of titles remains constant. For example, the addition of a new title in 1993 (*Advances in Ecological Research*) effectively increased by one the ranking of all titles with lower Impact Factors. Similarly, the exclusion of a title would have the effect of decreasing the ranking by one of titles which possess a lower Impact Factor.

To overcome the differential influence of titles with incomplete data on the relative ranking of titles from year to year, it was decided to restrict the analysis of the variation in the ranking to the 55 serials with complete data for 1991–95. Appendix Table 2A depicts the ranking of these 55 titles with respect to declining Impact Factor in each of the five years. The column labeled "Avg. Rank" depicts the ranking of each Ecology title with respect to its average Impact Factor over the years 1991–95. This shows, for example, that the *Annual Reviews of Ecology and Systematics* had the highest average Impact Factor over the period, while the *Canadian Field Naturalist* had the lowest average Impact Factor.

The columns labeled "1991–92", "1992–93", "1993–94" and "1994–95" in Table 2A depict the year-to-year change in Impact Factor ranking of each serial. A positive value (for example, 3) indicates that a serial's ranking rose three places; a negative value (for example, -5) indicates that a ranking fell five places. The final column in Table 2A indicates the net change in a serial's ranking over the entire period. Two interesting points emerge from this table. First, titles whose relative rankings fluctuate markedly from year to year can have a relative ranking that remains almost constant on average over the five-year period. Prime examples of this are the *Australian Journal of Ecology*, *Polar Biology*, *Biological Conservation* and *Ecological Modelling*. For each of these titles changes in the relative ranking in one year are reversed in a subsequent year to the extent that the overall ranking between 1991 and 1995 varies little. The second point is that several serials experienced a dramatic climb in their ranking over the period: *Wetlands*, +29; *Vegetatio*, +20; *Journal of Vegetation Science*, +13. At the same time, other titles experienced a dramatic fall in their Impact Factors; for example, the *Journal of Biogeography*, −15. Taken together, these points indicate the danger of making collection management decisions on the basis of Impact Factors for just one or two years.

Table 1A shows that the variation in Impact Factor over time can be sizeable when expressed as a percentage of the title's mean Impact Factor; specifically, the average standard error expressed as a percentage of the mean Impact Factor was 13.194% (Median = 9.444%). In some respects it was not too surprising that three of the first six titles with the highest Impact Factors (*Advances in Ecological Research*, *Wildlife Monographs*, and *Advances in Microbial Ecology*) had a higher-than-average variation in Impact Factor. One explanation for this is that these six titles publish a small number of reviews each year. If a title publishes a review of marginal interest to ecology researchers, this has a more significant effect on the title's Impact Factor compared with what happens if a non-reviewing serial publishes an uninteresting paper.

After appreciable variations over time in the ranking of serials had been identified (Tables 1A and 2A), it was decided to quantify the magnitude of variations in Impact Factors and employ statistical methods to establish whether specific titles have significantly different Impact Factors. Specifically, if Impact Factors are to be used to select one title over another, the Factors should differ statistically over the period. To test this, it was decided to determine the extent of overlap in Impact Factors during 1991–95 for the *Australian Journal of Ecology* and all the other Ecology serials in JCR. The last column (*t* test) in Table 1A indicates those titles whose Impact Factors were not significantly different from those of the *Australian Journal of Ecology*. Specifically, the Impact Factors for this title were not significantly different from 19 other Ecology titles, ranging from the *Journal of Ecology* (ranked 13 by Impact Factor) to the *Journal of Biogeography* (ranked 40).

The results displayed in Table 1A suggest that reliance on a single year's Impact Factors is hazardous. While the 1995 Impact Factor for the *Journal of Ecology* (2.019, ranked 13) was greater than the *Australian Journal of Ecology* (1.545, ranked 23), examination of earlier JCR figures reveals that the Impact Factor of the *Journal of Ecology* increased from a low of 0.915 in 1992 to its current high in 1995. Whether the Impact Factor of the *Journal of Ecology* will continue to remain high relative to the *Australian Journal of Ecology* remains to be seen in subsequent editions of JCR; if it does, then in future years the Impact Factors for the *Journal of Ecology* may be significantly different from the *Australian Journal of Ecology*.

Similar comments can be made when comparing the Impact Factors of *Science* and *Nature*. Figure 1 graphs the Impact Factors of *Science* and *Nature* between 1991 and 1995. It shows that the Impact Factor of *Nature* increased and overtook that of *Science* during this period. The *t* test, however, indicates that the mean Impact Factors of *Nature* and *Science* for the period were not significantly different ($p = 0.1705$). Thus the Impact Factor does not prove that significantly more citations are made to articles appearing in *Nature* than in *Science*, and it would be inappropriate to extrapolate Impact Factors into the future and select *Nature* ahead of *Science*.

Figure 2 presents the distribution of the year-to-year variation of Impact Factors of Ecology serials. The bar graph depicts the number of cases where the year-to-year variation was within a 5% range; there are 40 instances in which the variation was between 0 and 5%. The line graph

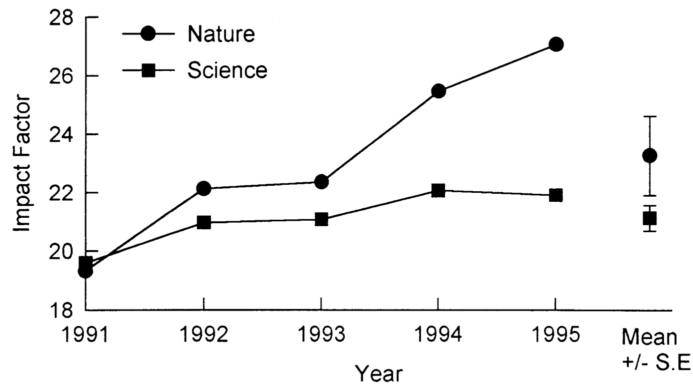

Figure 1. Impact Factors of *Science* and *Nature*, 1991–95.

depicts the cumulative percentage of the total number of cases; the percentage changes in Impact Factors of the six cases listed as greater than 155% were: 203.33, 247.93, 274.25, 281.1 and 981.1%

Since some studies have defined a journal's worth in terms of $ per Impact Factor, where Impact Factor reflects that for a given year rather than the average Impact Factor for a number of years, it was decided to investigate how the variability in Impact Factor can influence collection development decisions. The year-to-year variation in Impact Factor of each Ecology serial was determined, and the resulting distribution is shown in Figure 2. It was found that the average variation in Impact Factor was 33.679%, and the median variation in Impact Factor was 21.97%. This means that in half of the cases the year-to-year variation in Impact Factor exceeded 21.97% of the original Impact Factor.

From Figure 2 it is clear that a comparison of the worth of two journals as expressed by $ per

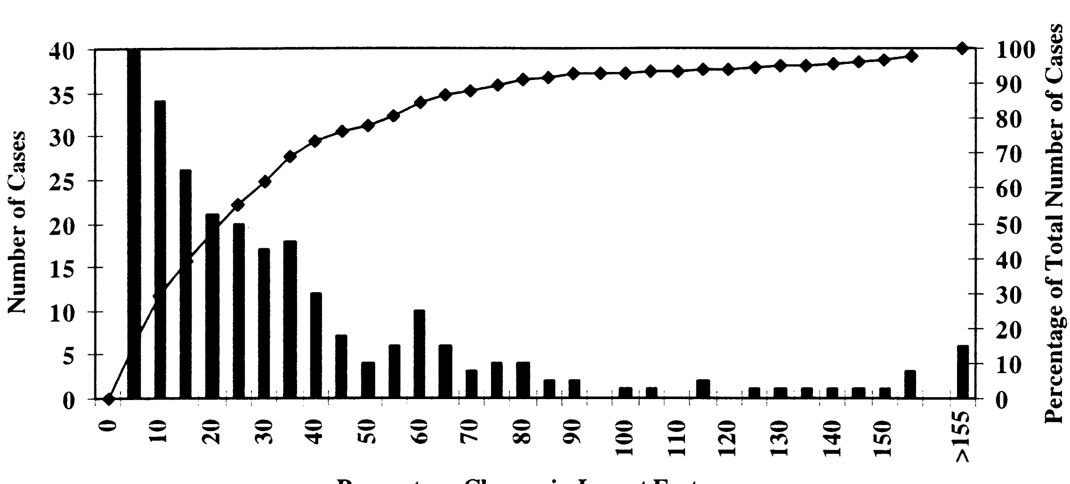

Figure 2. Change in Impact Factors.

TABLE 2
Change in Relative Worth of Serials

1994	Worth Serial A: Serial B
Serial A: $1000/Impact Factor + 22%	2:1
Serial B: $500/Impact Factor + 2%	
1995	
Serial A: $1000/1.22 Impact Factor	
$820/Impact Factor	
Serial B: $500/1.02 Impact Factor	1.64:1
$490/Impact Factor	

Impact Factor can change quite dramatically from year to year independently of differential change in the subscription price of two serials. Therefore, if one is comparing the worth of two serials, it should be recognized that there is a 50% chance that next year the Impact Factor of Serial A would have changed by more than 21.97%, and there is also a 50% chance that the Impact Factor of Serial B would have changed by more than 21.97%. If the Impact Factors for both Serials A and B changed in the same direction (that is, increased by *x* and *y*% respectively or decreased by *x* and *y*% respectively), then the change in the relative worth of the serials would be a reflection of the differential change in Impact Factors. This is displayed in Table 2.

Here the two serials, A and B, had a worth respectively of $1,000 and $500 per Impact Factor in 1994, which made their relative worth to the collection 2:1 in favor of Serial A. But in 1995 the cost of both serials remained unchanged, while their JCR Impact Factors altered to 1.22 for Serial A and 1.02 for Serial B; consequently, the worth of Serial A increased relative to Serial B, from 1:2 in 1994 to 1:674 in 1995.

To appreciate the frequency of observing a change of at least 48.77% in the relative worth of two serials from one year to the next, one can total the number of cases where Impact Factors increased by more than 21.97% (77 events) and the number of cases where Impact Factors decreased by more than 21.97% (53 events). This is displayed in Table 3, which outlines four cases in which a serial's Impact Factor changed by more than 21.97%. The arrows refer to an increase (↑) or decrease (↓) in Impact Factor. By definition, all events in cases 2 and 3 will result in at least a 48.77% change in the relative worth of Serials A and B. Consequently, these results suggest that there is a 24.57% chance that the ratio in worth between two serials altered by more than 48.77%. This figure is probably a slight underestimation in that there are a number of instances where the differential change of Impact Factors between Serials A↑ and B↑ or A↓ and B↓ are sufficiently great such that the change in worth would exceed 48.77%.

This example highlights problems which can arise when dividing numerators by potentially volatile Impact Factors. Librarians who intend to use the relative worth of each serial as a criterion for making selection or deselection decisions must be aware of the possible error associated with each title's worth. For instance, in Case 1 above, one might be tempted to cancel Serial B at the end of 1995, but what would one do if in 1996 the Impact Factor of Serial A declined by 30% and the Impact Factor of Serial B increased by 30%? In this instance Serial B would have greater worth than Serial A. Should one then cancel Serial A and reinstate Serial B in 1997?

Given the significant probability that a relative change in the worth of two serials could exceed

TABLE 3
Calculating the Relative Worth of Serials

Serial A	Serial B
50% chance of a less than 21.97% change in Impact Factor	50% chance of a less than 21.97% change in Impact Factor
50% chance of a more than 21.97% change in Impact Factor	50% chance of a more than 21.97% change in Impact Factor
Case 1 Serial A ↑ Serial B ↑	73/126 × 72/125 = 0.3337
Case 2 Serial A ↑ Serial B ↓	53/126 × 73/125 = 0.2457
Case 3 Serial A ↓ Serial B ↑	73/126 × 53/125 = 0.2457
Case 4 Serial A ↓ Serial B ↓	53/126 × 52/125 = 0.3337
Case 2 + Case 3 =	0.2457 + 0.2457 = 0.4914
	0.4914 × 126/252 = 0.2457

where 252 = total number of observations, and 126 = number of observations with a variation greater than the median.

48.77%, it was decided first to determine the quality (that is, Cost per Impact Factor) of each serial and then determine the extent of overlap in titles where the difference in the quality is less than 48%. These titles are the ones which are susceptible to inappropriate cancellation or inappropriate selection as a result of normal fluctuations in Impact Factors.

Appendix Table 3A ranks Ecology serials in descending order of quality based on $ per Impact Factor in 1995. This shows that the only serial whose worth does not overlap the worth of at least one other title is the *Russian Journal of Ecology*. The term “overlap” indicates that the worth of one serial is less than 48% different from that of another. Table 3A further indicates that for a number of titles costing about $245 per Impact Factor there are 24 other titles whose overlap in cost per Impact Factor is less than 48.77%; these could be subject to inappropriate selection as a result of normal yearly fluctuations in Impact Factors. The average number of titles with an overlapping cost per Impact Factor is 13.175 of a possible overlap of 63 titles.

CONCLUSIONS

From the above results it is clear that a great deal of care must be exercised when basing serial selection and deselection decisions on Impact Factors, which are volatile over time. In particular, the ranking of serials in terms of diminishing Impact Factors can change significantly, and decisions made today may well be regretted tomorrow. A related concern is that the publication of Impact Factors is at least two years behind the placement of a subscription. For example, Australian libraries did not receive the 1995 *Journal Citation Reports* until January 1997; these 1995 figures would then be used to make decisions effective in late 1997 or early 1998.

If collection managers are to use Impact Factors in selection/deselection decision-making, it is recommended that a factor of at least 3.0 for the cost per Impact Factor should be adopted to differentiate meaningfully between titles. That is, a title in a given subject area with a cost per Impact Factor greater than 3.0 times that of another serial in the same subject area warrants scrutiny for selection/deselection. Because a three-fold difference in cost per Impact Factor would require at least a 73.21% change in the Impact Factors of both serials (see Figure 2), this is relatively unlikely to occur by chance. Therefore, one may conclude that titles whose ratio of cost per Impact Factor exceeds 3.0 exhibit real differences in quality.

Rather than basing decisions on the Impact Factors for a single year, statistical procedures might be employed to determine whether the Impact Factors of two titles are significantly different over an extended period of time (three years or more) before the title with the lower Impact Factor is cancelled. It is recommended in particular that librarians plot the rank versus time of serials in a given discipline area as a means of determining which titles have increasing or decreasing citedness over time. Titles whose ranks are decreasing consistently over three years may be candidates for cancellation, while those with increasing citedness might be worth adding to a collection.

Given the findings of previous studies—that Impact Factors may be poor indicators of the local use of serials—faculty should be consulted before a decision is made to take a new title with a rapidly increasing Impact Factor but of perhaps limited local appeal. Conversely, only after either consultation with users or a use study should one cancel a serial with a low Impact Factor but high local use.

The concept of developing a quality Ecology collection by sequentially selecting titles from top to bottom (Table 3A) until the whole subject allocation has been spent is open to question. For instance, if two titles are of equal quality but one publishes more articles than the other, it might be more cost effective to purchase the title with more articles, as this achieves higher subject coverage. On this basis one might argue that it would be more cost effective to subscribe to *Oikos* than to the *New Zealand Journal of Ecology* although the Cost/Impact Factor of the latter is half that of the former (see Table 3A). This is because *Oikos* published eight times the number of articles published by the *New Zealand Journal of Ecology* in 1995 (that is, 156:22). Thus one might argue that collection managers should consider ranking serials according to $ per citation rather than $ per Impact Factor, using the following formulae:

$$\textit{Citations per article} \times \textit{Total articles per year} = \textit{Total citations per year}$$

$$\textit{Cost per year} \times 1/[\textit{Total citations per year}] = \textit{Cost per citation}$$

Even if it is more appropriate to base selection and deselection decisions on cost per citation than on serial quality cost per Impact Factor, the citation component of cost per citation is subject to the same year-to-year variability as that of the Impact Factor. Another source of variability in cost per citation comparisons is the number of citable articles in a serial, which can vary from year to year.

In conclusion, collection managers should not be swayed by hype associated with Impact Factors, and they should be aware of the degree of year-to-year variability associated with Impact Factor movement. While Impact Factors might provide a lead to the selection and deselection of serial titles, other factors, including the results of local use studies as well as consultation with journal users, should be taken into account prior to final decisions about title retention or discard.

NOTES

1. See Garfield, Eugene. “Citation Analysis as a Tool in Journal Evaluation,” *Science* 178 (1972), 471–9. For a recent review of literature related to this and other aspects of journal evaluation, see Altmann, Klaus G., and Gorman, G.E. “Usage, Citation Analysis and Costs as Indicators for Journal Deselection and Cancellation: A Selective Literature Review,” *Australian Library Review* 13, 4 (1996), 379–92.

2. Recent examples of this approach used in marketing journals include publicity letters from: Lenne P. Miller, Director of Journal Publications for The Endocrine Society, August, 1996; and Ingrid Benirschke, Marketing Manager for Cold Spring Harbor Laboratory Press, November 1996.
3. Christensen, John O. "Cost of Chemistry Journals to One Academic Library, 1980–1990," *Serials Review*, 18, (1992), 19–34.
4. Stankus, Tony. *Making Sense of Journals of the Life Sciences: From Speciality Origins to Contemporary Assortment*. New York: Haworth Press, 1992.
5. Stankus, Tony and Mills, C.V. "Which Life Science Journals Will Constitute the Locally Sustainable Core Collection of the, 1990s and Which Will Become 'Fax-Access' Only? Predictions Based on Citation and Price Patterns, 1979–1989," *Science and Technology Libraries* 13, (1992), 73–114.
6. See, for example, Line, Maurice B. "Rank Lists Based on Citations and Library Uses as Indicators of Journal Usage in Individual Libraries," *Collection Management* 2, 4 (1978), 313–16; Line, Maurice B., and Steemson, R.J. "Comparison of Ranked Lists of Journals," *Journal of Documentation*, 33, 2 (1977), 151–3; Scales, Pauline A. "Citation Analyses as Indicators of the Use of Serials: A Comparison of Ranked Lists Produced by Citation Counting and from Use Data," *Journal of Documentation* 32, 1 (1976), 17–25; Scanlan, Brian D. "Coverage by Current Contents and the Validity of Impact Factors: ISI from a Journal Publisher's Perspective," *Serials Librarian* 13, 2/3 (1987), 57–66; Smith, Thomas E. "The *Journal Citation Reports* as a Deselection Tool," *Bulletin of the Medical Library Association* 73 (1985), 387–9.
7. The fourteen new titles were: *Advances in Ecological Research, Molecular Ecology, Ecological Applications, Ecological Economics, Landscape Ecology, Ecography, Trees-Structure Function, Wildlife Research, Biodiversity Conservation, Ecological Research, Global Ecology and Biogeography Letters, European Journal of Soil Biology, Ekologia Bratislava,* and *Natural Areas Journal.*

APPENDIX

TABLE 1A
Impact Factors of Ecology Journals, 1991–95

Rank	Title	Impact Factors '91	'92	'93	'94	'95	Mean 1991-95	Standard Error	SE as % of Mean	*t*-Test
1	*Adv Ecol Res*			2.722	2.895	5.545	3.720	0.913	24.553	
2	*Wildlife Mono*	2.667	3.000	2.000	3.400	5.400	3.293	0.574	17.443	
3	*Ann Rev Ecol & Sys*	4.000	4.341	4.31	4.825	4.761	4.447			
4	*Ecol Mono*	4.757	3.615	4.050	4.838	4.571	4.366	0.232	5.326	
5	*Tr Ecol & Evol*	2.985	2.858	3.517	4.106	4.439	3.581	0.308	8.602	
6	*Adv Microbial Ecol*		2.083	1.600	4.053	4.000	2.934	0.638	21.762	
7	*Ecol*	2.588	2.628	2.561	2.818	3.131	2.745	0.106	3.877	
8	*Molecular Ecol*					2.992	2.992	0.000	0.000	
9	*Amer Naturalist*	2.467	2.271	2.640	3.240	2.815	2.686	0.165	6.149	
10	*Evol*	3.082	2.806	2.760	2.349	2.540	2.707	0.124	4.593	
11	*Jl Animal Ecol*	2.048	2.028	2.135	2.517	2.485	2.242	0.107	4.777	
12	*Ecol Appl*		1.868	2.537	1.556	2.231	2.048	0.213	10.426	
13	*Jl Ecol*	1.158	0.915	1.045	1.672	2.019	1.361	0.208	15.313	0.341
14	*Conserv Biol*	0.967	1.224	1.538	1.643	2.004	1.475	0.177	12.061	0.136
15	*Mar Ecol Prog Ser*	2.019	1.730	1.540	1.827	1.949	1.813	0.084	4.643	
16	*Oikos*	1.494	1.467	1.566	1.765	1.942	1.646	0.091	5.488	
17	*Microbial Ecol*	1.600	2.032	1.775	1.814	1.870	1.818	0.070	3.848	
18	*Jl Evol Biol*	1.636	1.418	1.476	1.314	1.852	1.539	0.094	6.105	
19	*Evol Ecol*	1.673	1.295	1.268	2.081	1.688	1.601	0.149	9.345	
20	*Vegetatio*	0.536	0.326	0.412	1.049	1.635	0.791	0.245	30.993	0.268
21	*Func Ecol*	1.495	1.259	1.565	1.514	1.620	1.490	0.061	4.149	
22	*Oecologia*	1.596	1.496	1.386	1.366	1.569	1.482	0.046	3.143	

Rank	Title	Impact Factors '91	'92	'93	'94	'95	Mean 1991-95	Standard Error	SE as % of Mean	*t*-Test
23	*Aust Jl Ecol*	1.132	0.990	0.806	1.115	1.545	1.117	0.121	10.890	1.000
24	*Jl Appl Ecol*	0.852	1.167	0.865	1.013	1.382	1.055	0.099	9.437	0.704
25	*Wetlands*	0.121	0.421	0.375	0.548	1.348	0.562	0.208	37.016	0.095
26	*Polar Biol*	1.074	1.159	0.873	0.866	1.331	1.060	0.088	8.328	0.714
27	*Tree Physio*	0.562	1.124	1.101	1.030	1.299	1.023	0.123	12.070	0.601
28	*Jl Chem Ecol*	1.271	1.350	1.407	1.048	1.220	1.259	0.061	4.907	0.329
29	*Biol Conserv*	0.816	0.847	0.746	0.745	1.175	0.865	0.079	9.218	0.222
30	*Jl Vege Sci*	0.494	1.611	0.600	0.739	1.168	0.722	0.118	16.332	0.095
31	*Theor Pop Biol*	0.859	1.188	1.120	1.465	1.079	1.142	0.097	8.555	0.878
32	*Jl N Amer Bentho Soc*	0.939		1.129	0.920	1.076	1.016	0.051	5.044	0.506
33	*Jl Exper Mar Biol & Ecol*	1.157	1.075	1.036	1.268	1.076	1.122	0.041	3.688	0.971
34	*Ecol Econ*			0.731	1.313	1.073	1.039	0.168	16.253	0.713
35	*Landscape Ecol*		0.708	0.540	0.767	1.000	0.753	0.095	12.621	0.058
36	*Jl Wildlife Mgt*	0.770	0.872	0.778	0.797	0.960	0.835	0.036	4.308	0.056
37	*Ecol Model*	0.601	0.364	0.551	0.683	0.898	0.619	0.087	14.070	
38	*Ecography*			0.620	0.753	0.883	0.752	0.075	10.096	0.077
39	*Trees Struct Func*			0.750	0.921	0.862	0.844	0.050	5.940	0.151
40	*Jl Biogeog*	1.314	0.708	1.080	0.794	0.792	0.937	0.113	12.079	0.310
41	*Wildlife Res*		0.429	0.540	0.511	0.773	0.563	0.073	13.095	
42	*Biodiv & Conserv*		0.847	0.640	0.822	0.731	0.731	0.047	6.447	
43	*Biotropica*	0.824	0.638	0.763	0.872	0.675	0.754	0.043	5.823	
44	*Biochem & System Ecol*	0.750	0.712	0.690	0.746	0.665	0.712	0.016	2.283	
45	*Jl Soil & Water Conserv*	0.477	0.442	0.573	0.439	0.626	0.511	0.037	7.339	
46	*NZ Jl Ecol*	0.587	0.588	0.242	0.167	0.625	0.441	0.097	22.146	
47	*Jl Trop Ecol*	0.679	0.566	0.774	0.655	0.589	0.652	0.036	5.628	
48	*Pedobiologica*	0.354	0.570	0.557	0.441	0.566	0.497	0.432	8.676	
49	*Envir Biol Fishes*	0.745	0.727	0.787	0.634	0.557	0.690	0.041	6.030	
50	*Amer Midland Naturalist*	0.475	0.453	0.500	0.404	0.531	0.472	0.021	4.551	
51	*Wildlife Soc Bull*	0.565	0.444	0.392	0.365	0.503	0.453	0.036	8.034	
52	*Acta Oecologica*	0.317	0.542	0.523	0.543	0.496	0.484	0.042	8.180	
53	*Afr Jl Ecol*	0.265	0.419	0.263	0.366	0.444	0.351	0.037	10.768	
54	*Ecol Res*			0.268	0.293	0.439	0.333	0.053	15.996	
55	*Jl Arid Envir*	0.500	0.496	0.304	0.545	0.412	0.451	0.042	9.451	
56	*Jl Range Mgt*	0.550	0.483	0.609	0.410	0.405	0.491	0.039	8.067	
57	*Rev d'Ecol*	0.370	0.367	0.217	0.491	0.286	0.346	0.046	13.281	
58	*NW Envir Jl*	0.100	0.109	0.077	0.090	0.273	0.129	0.016	12.473	
59	*Great Basin Naturalist*	0.075	0.124	0.093	0.147	0.264	0.140	0.033	23.649	
60	*Colonial Waterbirds*	0.500	0.154	0.121	0.162	0.259	0.239	0.069	28.905	
61	*SW Naturalist*	0.111	0.133	0.139	0.147	0.223	0.150	0.019	12.656	
62	*Recher Pop Ecol*	0.439	0.404	0.411	0.310	0.194	0.351	0.047	13.481	
63	*NW Science*	0.183	0.200	0.127	0.296	0.164	0.194	0.028	14.557	
64	*Global Ecol & Biogeog*		1.050	0.475	0.225	0.158	0.477	0.202	42.518	
65	*Eur Jl Soil Biol*				0.087	0.152	0.119	0.032	27.197	
66	*Ekologia Bratis*			0.031	0.013	0.133	0.059	0.037	63.322	
67	*Amazoniana*	0.100	0.571	0.227	0.147	0.130	0.235	0.086	36.847	
68	*Natural Areas Jl*				0.222	0.125	0.173	0.048	27.954	
69	*SA Jl Wildlife Res*	0.284	0.263	0.275	0.216	0.116	0.230	0.031	13.431	
70	*Biocycle*	0.182	0.194	0.092	0.089	0.077	0.126	0.011	8.880	
71	*Canad Field Naturalist*	0.044	0.093	0.082	0.063	0.060	0.068	0.086	125.980	
72	*Russ Jl Ecol*				0.049	0.060	0.054	0.005	10.092	
73	*Sov Jl Ecol*	0.048	0.047	0.000	0.016		0.027	0.011	42.750	

TABLE 2A
Ranking of Ecology Journals, 1991-95

Title	Impact Factor Rank by Year						Change in Rank between Years				
	’91	’92	’93	’94	’95	Avg Rank	’91-’92	’92-’93	’93-’94	’94-’95	’91-’95
Ann Rev Ecol & Sys	2	1	1	2	2	1	1	0	−1	0	0
Ecol Mono	1	2	2	1	3	2	−1	0	1	−2	−2
Tr Ecol & Evol	4	4	3	3	4	3	0	1	0	−1	0
Wildlife Mono	5	3	8	4	1	4	2	−5	4	3	4
Ecol	6	6	6	6	5	5	0	0	0	1	1
Evol	3	5	4	8	7	6	−2	1	−4	1	−4
Amer Naturalist	7	7	5	5	6	7	0	2	0	−1	1
Jl Animal Ecol	8	9	7	7	8	8	−1	2	0	−1	0
Microbial Ecol	12	8	9	11	13	9	4	−1	−2	−2	−1
Mar Ecol Prog Ser	9	10	12	10	11	10	−1	−2	2	−1	−2
Oikos	15	12	10	12	12	11	3	2	−2	0	3
Evol Ecol	10	15	17	9	15	12	−5	−2	8	−6	−5
Jl Evol Biol	11	13	14	18	14	13	−2	−1	−4	4	−3
Func Ecol	14	16	11	15	17	14	−2	5	−4	−2	−3
Oecologia	13	11	16	17	18	15	2	−5	−1	−1	−5
Conserv Biol	22	17	13	14	10	16	5	4	−1	4	12
Jl Ecol	18	24	21	13	9	17	−6	3	8	4	9
Jl Chem Ecol	17	14	15	22	24	18	3	−1	−7	−2	−7
Theor Pop Biol	23	18	18	16	27	19	5	0	2	−11	−4
Jl Exper Mar Biol & Ecol	19	22	22	19	28	20	−3	0	3	−9	−9
Aus Jl Ecol	20	23	25	20	19	21	−3	−2	5	1	1
Polar Biol	21	20	13	26	22	22	1	−3	−3	4	−1
Jl Appl Ecol	24	19	24	24	20	23	5	−5	0	4	4
Tree Physio	34	21	19	23	23	24	13	2	−4	0	11
Jl Biogeog	16	29	20	28	31	25	−13	9	−8	−3	−15
Biol Conserv	26	26	30	30	25	26	0	−4	0	5	1
Jl Wildlife Mgt	27	25	27	27	29	27	2	−2	0	−2	−2
Vegetatio	36	47	39	21	16	28	−11	8	18	5	20
Biotropica	25	30	29	25	32	29	−5	1	4	−7	−7
Jl Vege Sci	39	31	33	31	26	30	8	−2	2	5	13
Biochem & System Ecol	28	28	31	29	33	31	0	−3	2	4	7
Envir Biol Fishes	29	27	26	34	38	32	2	1	−8	−4	−9
Jl Trop Ecol	30	35	28	33	36	33	−5	7	−5	−3	−6
Ecol Model	31	46	36	32	30	34	−15	10	4	2	1
Wetlands	50	42	42	35	21	35	8	0	7	14	29
Jl Soil & Water Conserv	40	41	34	40	34	36	−1	7	−6	6	6
Pedobiologia	44	34	35	39	37	37	10	−1	−4	2	7
Jl Range Mgt	35	38	32	41	44	38	−3	6	−9	−3	−9
Acta Oecologica	45	36	37	37	41	39	9	−1	0	−4	4
Amer Midland Naturalist	41	39	38	42	39	40	2	1	−4	3	2
Wildlife Soc Bull	33	40	41	44	40	41	−7	−1	−3	4	−7
Jl Arid Envir	37	37	43	36	43	42	0	−6	7	−7	−6
NZ Jl Ecol	32	32	46	48	35	43	0	−14	−2	13	−3
Recher Pop Ecol	42	44	40	45	50	44	−2	4	−5	−5	−8
Afr Jl Ecol	47	43	45	43	42	45	4	−2	2	1	5
Rev d’Ecol	43	45	48	38	45	46	−2	−3	10	−7	−2

Title	Impact Factor Rank by Year '91	'92	'93	'94	'95	Avg Rank	Change in Rank between Years '91-'92	'92-'93	'93-'94	'94-'95	'91-'95
Colonial Waterbirds	37	51	51	49	48	47	−14	0	2	1	−11
Amazoniana	52	33	47	50	52	48	19	−14	−3	−2	0
S Afr Jl Wildlife Res	46	48	44	47	53	49	−2	4	−3	−6	−7
NW Science	48	49	50	46	51	50	−1	−1	4	−5	−3
SW Naturalist	51	52	49	50	49	51	1	−3	−1	1	2
Great Basin Naturalist	54	53	52	50	47	52	1	1	2	3	7
NW Envir Jl	52	54	55	53	46	53	−2	−1	2	7	6
Biocycle	49	50	53	54	54	54	−1	−3	−1	0	−5
Can ad Field Naturalist	55	55	54	55	55	55	0	1	−1	0	0

TABLE 3A
Ranking of Ecology Journals by Quality (A$/Impact Factor)

Rank	Title	Cost/Impact Factor (A$)	Overlap	Articles (1995)
1	*Ann Rev Ecol & Sys*	15.35	1	30
2	*Ecol Mono*	15.43	1	18
3	*Ecol Appl*	48.84	1	105
4	*Jl N Amer Bentho Soc*	71.49	2	51
5	*Evol*	80.76	1	134
6	*Ecol*	110.56	3	237
7	*Amer Naturalist*	111.13	3	111
8	*Jl Soil & Water Conserv*	122.88	6	104
9	*NZ Jl Ecol*	168.29	17	22
10	*Jl Wildlife Mgt*	173.61	17	107
11	*Conserv Biol*	179.13	17	175
12	*Biotropica*	180.43	17	68
13	*Tr Ecol & Evol*	183.26	16	69
14	*Wetlands*	190.22	16	43
15	*Amer Midland Naturalist*	193.15	16	82
16	*Jl Animal Ecol*	200.15	17	70
17	*SW Naturalist*	201.21	17	64
18	*Ecography*	219.59	20	33
19	*Colonial Waterbirds*	222.74	21	46
20	*Wildlife Soc Bull*	229.38	22	83
21	*Molecular Ecol*	233.85	22	94
22	*Microbiol Ecol*	235.50	22	48
23	*Aust Jl Ecol*	236.25	22	57
24	*Great Basin Naturalist*	242.80	24	51
25	*Jl Ecol*	246.34	24	90
26	*SA Jl Wildlife Res*	296.38	20	12
27	*Landscape Ecol*	305.55	19	29
28	*Func Ecol*	307.02	19	100
29	*Wildlife Res*	323.42	19	55
30	*Evol Ecol*	330.86	18	53
31	*Oikos*	335.27	17	156
32	*Jl Range Mgt*	354.54	13	92
33	*Jl Appl Ecol*	359.89	14	77
34	*NW Science*	371.34	12	34

Rank	Title	Cost/Impact Factor (A$)	Overlap	Articles (1995)
35	*Jl Trop Ecol*	422.21	13	50
36	*Jl Evol Biol*	435.93	13	46
37	*Tree Physio*	446.10	12	109
38	*Jl Vege Sci*	532.77	7	85
39	*Theor Pop Biol*	616.66	8	26
40	*Ecol Res*	747.63	13	39
41	*Acta Oecologica*	805.16	15	26
42	*Pedobiologia*	894.26	15	53
43	*Jl Chem Ecol*	903.74	15	148
44	*Polar Biol*	939.04	14	80
45	*Afr Jl Ecol*	939.82	14	35
46	*Trees Struct Func*	982.87	14	51
47	*Canad Field Naturalist*	987.19	14	32
48	*Ecol Econ*	1006.68	14	76
49	*Natural Areas Jl*	1025.68	15	34
50	*Biocycle*	1048.96	17	212
51	*Biodiv & Conserv*	1052.31	16	72
52	*Biol Conserv*	1156.88	15	136
53	*Jl Biogeog*	1157.53	15	60
54	*Recher Pop Ecol*	1189.54	15	16
55	*Vegetatio*	1516.26	9	84
56	*Biochem & System Ecol*	1527.53	8	118
57	*Eur Jl Soil Biol*	1787.30	7	12
58	*Jl Arid Envir*	1790.36	7	126
59	*Mar Ecol Prog Ser*	2459.54	6	397
60	*Envir Biol Fishes*	2544.15	6	122
61	*Oecologia*	2545.43	6	260
62	*Ecol Model*	2626.39	6	163
63	*Jl Exper Mar Biol & Ecol*	3077.59	4	152
64	*Russ Jl Ecol*	25,641.00	0	53