Citation patterns of papers published in *Ornis Fennica*

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In order to explore the effectivity of *Ornis Fennica* as a scientific communication channel for Finnish ornithologists, we studied how the 179 Finn-authored papers published in *Ornis Fennica* in 1963–82 were cited by foreign and Finnish authors in international journals according to the *Science Citation Index* in 1983–86. Autocitations were excluded. Nearly 50% of the papers were not cited, but of the recent papers (1978–82) about three-quarters received citations in 1983–86. Papers on theoretical issues and behavioural and evolutionary ecology were cited at least ten times more often than reviews of national programs or papers on the distribution of species. Papers in German were cited somewhat less than expected on the basis of their topics, indicating a language barrier.

Finnish and foreign authors tended to have similar citation patterns, although papers in behavioural ecology and those of a more theoretical nature received especially many foreign citations. Papers on local phenomena were mostly cited by Finns. Papers examining the effect of unusual weather on Finnish birds were particularly frequently cited by Finns. Uncitedness followed opposite trends. Indeed, the differences in the citation rate between subject areas were largely explained by differences in the frequency of uncited papers.

The temporal distribution of citations by Finns and by foreign authors differed strikingly. Papers in recent issues of *Ornis Fennica* (1978–82) were largely ignored by foreign authors. In general there was a 5–10 year lag before even present citation favourites were internationally recognized.

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Introduction

One indication of the usually positive (Chubin & Moitra 1975) scientific interest of a paper is the number of times it is cited by colleagues in scientific journals (see Garfield 1979). It is not only the paper's message that affects the number of citations. Other factors involved are the size of the scientific community (there are more biochemists than ornithologists), the journal (papers in *The Auk* are more easily cited than papers published in *Kerava-seuran julkaisuja*), the publication language (English is preferred to Finnish or Lapp) and the development of the science (compare the success of a faunistical and a statistical paper among ornithologists 100 years ago with today). It is also clear that using the number of citations as *the* definition of the scientific quality of a paper is absurd (Mendel's work in the 19th century is a classic case in biology; and in taxonomy, outstanding papers are often not cited until the next revision of the group). In the following, we do not assume, nor do we believe in a 1:1 relationship between the number of citations and quality (for an analysis of the concepts "quality", "impact", "importance" and "progress", see Niiniluoto 1987; see also Luukkonen-Gronow 1987).

In order to examine the effectivity of *Ornis Fennica* as an information channel from Finnish ornithologists to international ornithologists, we analysed how papers in *Ornis Fennica* have been cited in international journals. We included all papers (excluding brief reports) in English or German that were:

— written by Finnish authors (the nationality of the first author was used in deciding the origin of multiauthored papers) and

— published in the volumes 40–59 (i.e. years 1963–82) of *Ornis Fennica* (later abbreviated OF).

The citation patterns were examined on the basis of the *Science Citation Index* (SCI) for the years 1983–86. (This period was chosen as we were not interested in possible historical changes in the citation

patterns but only in recent citations.) The SCI covers the most important international journals and shows the citations in all papers published in the journals included in the SCI. OF was not included in the SCI in 1983–86; the only journal published in Finland that had any influence on the results was *Annales Zoologici Fennici*.

The citations were classified into three groups: citations by foreign authors, citations by Finns, and autocitations (author citing own papers). Autocitations were excluded from our analysis, as a paper is always a good communication channel to its author, irrespective of the journal.

Classification of the papers

In order to better understand the citation patterns we classified the topics into the following broad classes:

National programs. Reviews and presentations of the results of national programs, such as the winter bird census, the nest card scheme, ringing reports, or bird station activities.

Unique events. Papers describing the effect of an unusual event (severe winters, cold springs, cool and rainy summers, etc.) on bird populations.

Distribution. Papers describing the distribution of a species, mostly in Finland. Papers on range changes included.

Local censuses. Papers describing quantitatively the birds of a certain area, in a few cases also reporting long-term changes in numbers.

Breeding biology. Papers describing the basic breeding biology of different species.

Population dynamics. Papers estimating population dynamical parameters on the basis of individually marked birds, including papers on dispersal.

Biometry. A mixed bag of papers relating to (traditional) biometry, taxonomy, morphology, nestling growth, ageing, identification etc. Papers on egg size were classified as basic breeding biology, except one paper (on genetics) which was considered (behavioural and) evolutionary ecology.

Food. Mostly descriptions of the diets of predatory birds.

Ethology. Descriptive papers on bird behaviour.

Behavioural and evolutionary ecology. Papers discussing behavioural and/or evolutionary aspects from an ecological standpoint (e.g. foraging, breeding strategies, breeding systems, social behaviour, life histories, habitat selection). Note that our definition is broader than the normal usage of the terms but the small number of papers in this category prevented further division.

Migration. Papers describing the migration of a species, including irruptions.

Methods. Descriptions or tests of methods.

Theory. Papers discussing general, frequently evolutionary hypotheses and their testing.

All papers did not fit well into the above classes. Therefore, the few papers on faunistics, zoogeography, moult, pesticides, and bird protection are not included in the above classes. Some papers belonged to two classes and were classified into both of them.

Some additional classifications were adopted. First, *congress papers* were usually not cited. There were eight congress papers, but only two of them received citations. The reason seems simple: a sketchy overview may be a good introduction, but the essence is in the papers presenting the original ideas or data.

Second, papers were classified according to their *language* : English or German. A total of 26 papers were written in German, most of them in the 1960s.

Different subject areas attract varying attention

We checked all subject areas for possible effects of single authors on the results. In two cases the results were decisively affected by a single individual: Theoretical papers numbered only five, and two of them were frequently-cited papers by Lars von Haartman. The position of theoretical papers would be about that of an average subject area without these two papers. Second, migration papers would rank clearly lower without one frequently-cited paper by von Haartman. In no other class did single persons or papers have a major effect on the results.

The relative citation frequency of the papers is shown in Fig. 1. The average citation frequency was set as unity, which helps in comparisons. The three favoured subject areas were theory, behavioural and evolutionary ecology and population dynamics. The three subject areas receiving least citations per paper were reviews of national programs, papers on distribution, and ethology.

The same calculations were also made by calculating citation frequency per page. The overall picture was similar to Fig.1. As the average length of papers varied among the subject areas, those characterized by long papers (behavioural ecology, migration, population dynamics, reviews of national programs,

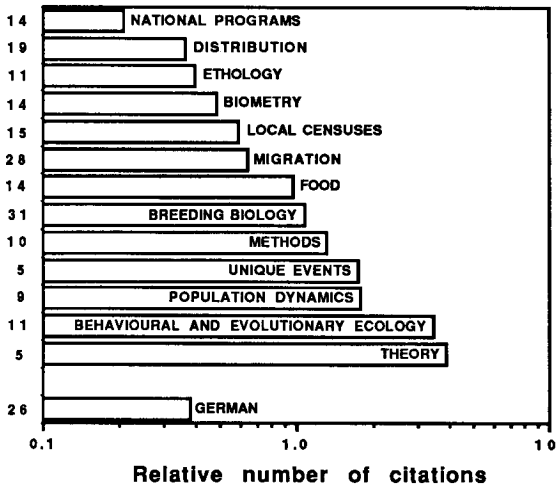

Fig.1. Relative citation rates of papers belonging to different subject areas of ornithology. Average citation frequency of all papers = 1. Papers in the most cited subject areas had more than 10 times higher citation rates than those in the lowest classes. Numbers of papers in different classes on the left.

unique events) somewhat lost ground, while subject areas characterized by short papers (methods, food, biometry, theory) improved their positions. Paper length, in fact, also affects citation rate per page: short papers (1–4 pp.) were cited three times as frequently as long papers (over 20 pp.), as established in an analysis of variance ($P<0.05$). However, this may be a consequence of the fact that some long papers in OF have included archival documentation that seldom invites citations in the general literature.

The above data do not establish conclusively that there are genuine differences between subject areas in citation rate. Therefore, the data were tested by analysis of variance. As the citation frequencies are highly skewed, it was necessary to use a log(n+1) transformation. The result was highly significant ($P<0.001$). The citation rates vary tremendously between subject areas. It is thus difficult to predict a paper's citation frequency from the journal in which it is published — not only do citation rates vary among papers on the same subject, but papers published in the same journal but on different subject areas, even within such a narrow field as ornithology, have quite different citation rates.

The scientific importance of an average paper is certainly not directly related to the columns in Fig. 1. For example, descriptive ethology and papers on distribution are not frequently cited, but they are essential for handbooks not covered by the SCI. Reviews of national programs may lead readers to examine the original data and may thus have an indirect effect. Local censuses do not receive widespread attention but can be essential to those needing good data for geographical or long-term comparisons (the archival function of OF). On the other hand, the fact that behavioural and evolutionary ecology has been very popular internationally in recent years no doubt contributes to the high citation frequency of papers in that subject area. Science is not free of fashions.

Fig. 1 also shows the sad fate of German papers. One could argue that this column is low because most German papers included in the analysis were published in the 1960s and probably deal with subject areas that are not so up-to-date; therefore the citation frequency is low. However, this is not exactly so. As a two-way analysis of variance showed, when the effects of subject area and language were examined simultaneously, both had a significant effect (subject area $P<0.001$, language $P<0.02$). However, the interaction term was nearly significant ($P=0.054$). Indeed, when we removed one subject area (theory, having only 5 papers in total), neither the effect of language nor the interaction term were significant ($P>0.1$ for both), whereas the effect of subject area was still highly significant ($P<0.001$). In these analyses no subject areas were included that had no German papers.

Our results suggest that the German language presents a barrier to the now active generation of ornithologists (or scientists in general; see Watson 1985), but the subject areas of the papers published in German may also play a role. A review of a national program written as a short congress paper in German seems to be a superb candidate for a paper never to be cited.

Fig. 1 suggests that the editing of papers could be improved in order to increase OF's international interest. For example, publishing primary data, say, on migration or distribution in Finnish journals or storing them in archives could be a useful alternative to publishing such data in detail in OF.

This policy would probably also reduce the high number of papers that are not cited at all; almost half (48%) of the papers published in 1963–82 went apparently unnoticed in 1983–86. This observation suggests that more papers should also be refused than has been the case. However, there is also a temporal pattern that is evident: 18 of the 31 papers published

in 1963–67 received no citations, while the proportion was slightly less than one-half in 1968–77 and only about one-quarter in 1978–82.

Uncitedness followed the pattern in Fig. 1 quite closely. This does not immediately follow from the above analyses, as the frequency of uncited papers and the average citation rate are not necessarily related (theoretically at least, all subject areas might have the same proportion of uncited papers but could differ only because of differences in the citation rate of the cited papers). At most 20% of the papers in the five top classes (from theory to methods) were entirely uncited. About 35–40% of the papers on breeding biology, food and local censuses were uncited. The majority of papers in other subject areas were not cited at all; the highest proportions of uncitedness were in national programs (79%), migration (64%) and biometry (57%). The frequency of uncited papers varied highly significantly between subject areas (χ^2-test, $P<0.001$). German papers were also frequently (73%) uncited.

The analysis of uncitedness suggests that the differences in the citation rate between subject areas are largely explained by the frequency of uncited papers. When uncited papers were excluded from the analysis, the differences between subject areas were not significant (note, however, that this test was not powerful: the data set was reduced by about 50% and thus many subject areas were represented by a few papers only).

Finnish and foreign authors cite and uncite OF-papers differently

Some topics interest Finns and foreign authors differently (Fig. 2), even though the SCI covers only internationally important journals (including local ornithological journals would undoubtedly increase the citation rate of local topics). For ease of comparison, we have standardized the figures so that the citation frequency of an average paper equals unity (with variance = 1) on both axes (the actual number of citations by foreign authors was more than twice as high as the number of citations by Finns).

Most subject areas receive about the same relative amount of attention from Finns and foreign authors, but the regression model is far from significant ($P>0.2$). More importantly, the slope differs fairly significantly ($P<0.05$) from unity; this slope would be expected in cases where Finns and foreign authors cite papers on different subject areas at the same rates.

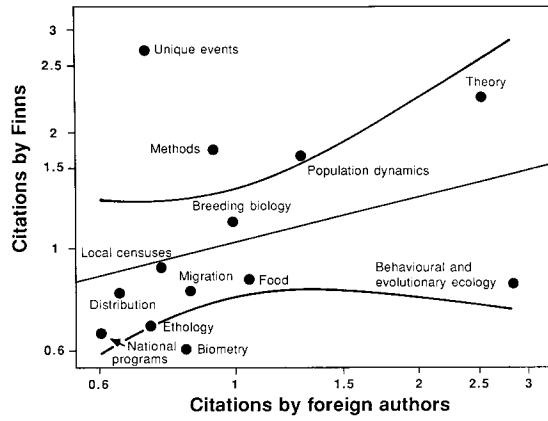

Fig. 2. Relative citation rates by foreign authors and by Finns to papers published in Ornis Fennica. The citation rates were so standardized that the citation rate of an average paper = 1 on both axes (variance = 1); in addition, the figures have been log-transformed for visual clarity. The regression (with 95% confidence limits for the mean of y) is not statistically significant and differs clearly ($P<0.05$) from the line y=x, owing to the effects of two categories: unique events and behavioural and evolutionary ecology.

However, a few notable exceptions explain some of the discrepancy.

First, Finns cite papers on unique events quite frequently. An optimistic interpretation could be that the strong naturalist tradition among Finnish ornithologists has made them realize that "years are not brothers", as a popular saying in Finland goes; i.e., patterns based on one or a few seasons may not be representative. A more realistic interpretation is that papers on, say, the effects of the severe winter of 1968/69 or of the poor summer of 1981 on Finnish birds are obviously of much greater relevance for Finnish ornithologists than for their American, French or Australian colleagues.

Second, behavioural and evolutionary ecology is frequently cited by foreign readers of OF but rarely by Finns. This is no doubt due to the intensity of behavioural and evolutionary ecology in international but not in Finnish ornithology.

Third, some papers on methods were essentially tests of methods as applied to Finnish conditions, and therefore received citations mostly from Finnish authors. (Some methods may work differently in Finland than in more southern areas where, for example, the breeding season of the birds is much longer.)

We examined the relative citation rates of Finnish and foreign authors in greater detail by subjecting the

Table 1. The observed and expected frequencies of citations in international journals to papers published in *Ornis Fennica* in four 5-year periods according to the *Science Citation Index* in 1983–85. The citations by Finns and by foreign authors are given separately.

Years	Papers	Observed		Expected
		Finns	Foreign authors	
1963–67	31	5.8%	6.1%	10.4%
1968–72	52	24.3%	46.9%	19.9%
1973–77	49	18.9%	24.7%	25.7%
1978–82	47	51.3%	22.2%	44.2%

difference in the standardized scores of citation rate per article by Finns and foreign authors to an analysis of variance. The subject area had a major effect ($P<0.001$) on the differences between Finns and foreign authors. Unique events and behavioural and evolutionary ecology contributed much to the pattern observed.

We also analysed uncitedness in this perspective and found that Finns and foreign authors had a similar tendency to uncite papers: uncitedness of papers in different subject areas was closely correlated ($P < 0.01$). However, this result was only obtained when two subject areas were excluded: Finns cited few papers on behavioural and evolutionary ecology and foreign authors cited few papers on unique events. If these subject areas are included, the model is not statistically significant. These results merely corroborate our previous findings and are therefore not presented in detail.

Fig. 2 reminds us of the fact that, particularly in ecology, there are local phenomena that are important and must be covered adequately, even though the international impact of papers examining such phenomena is not large. For example, ignoring unusual seasons might produce poor ecology, even though the particular vagaries of the Finnish weather may not be too exciting internationally.

Citations by foreign authors show a disturbing time lag

A somewhat disturbing result was obtained when we divided the papers into four 5-year periods. The citations by Finns followed the normal pattern: many citations to recent papers, and less and less citations to older papers (Table 1). The "normal pattern" was derived from the temporal distribution of citations in *Ornis Scandinavica* 4/1984 and *The Auk* 2/1985. G-tests show a highly significant ($P<0.001$) difference between the observed and expected distributions for foreign citations but not for the citations by Finns ($P>0.1$). The patterns in *The Auk* and in *Ornis Scandinavica* were similar ($P>0.3$), whereas the citation patterns of Finns and foreign authors differed drastically ($P<0.001$).

Papers in 1963–67 were cited less than expected at least for two reasons: the number of papers was lower than in later periods, and many of the papers were in German. A two-way analysis of variance indicated that the subject areas studied earlier had no influence on the result ($P>0.3$; the interaction term was also clearly nonsignificant).

The citations by foreign authors suggest a clear time lag: the absolute number of citations to papers published in 1968–72 was about twice as high as those papers published in 1973–77 or in 1978–82. We support our claim by reviewing the citation history in the SCI of the five papers most frequently cited in 1983–86. These were:

1) von Haartman 1968 (evolution of the migratory habit),

2–3) Lemmetyinen 1971 (nest defence in terns) and Väisänen et al. 1972 (genetics of egg size in shorebirds),

4) Hildén & Vuolanto 1972 (breeding biology of the Phalarope), and

5) von Haartman 1969 (evolution of polygamy).

Incidentally, over 90% of citations to these papers were by foreign authors; this percentage is much lower (about 60%) among citations to other papers (χ^2-test, $P<0.001$). The citation history of these papers since 1973, when even the latest ones of the five papers had been published, has been as follows (all citations are included here, but they were almost exclusively by foreign authors):

von Haartman 1968: First citation in 1976(!), several citations per year only since 1981, or 13 years since publication.

Lemmetyinen 1971: Two citations in 1976, but fairly regularly cited only since 1978 (7-year-time lag).

Väisänen et al. 1972: First citation in 1977, several citations per year first in 1979 (7-year-time lag).

Hildén & Vuolanto 1972: First cited in 1975, several citations per year regularly since 1977 (5-year-time lag).

von Haartman 1969: Cited regularly since 1974 (5-year-time lag).

Such citation patterns show that the recognition of many good papers in OF has been inordinately delayed. The recent inclusion of OF in the *Current Contents* will probably improve the situation in the future. Of course, the same patterns indicate a more positive fact: many papers in OF are worth citing even after decades. Not unexpectedly, *primus inter pares* here is Pontus Palmgren: the SCI in 1983–86 includes citations to eight different papers that he published in *Ornis Fennica* in the 1930s! These findings are in disagreement with what has been found in some other studies. For example, Kessler & Heart (1962) concluded that papers not cited during the first five years of their publication are not likely to be cited in the future (but see Ghosh 1975). It seems, however, to be a necessary condition for a citation favourite in OF that it will not be cited within the first five years since its publication!

Table 1 definitely suggests that there is plenty of work to do in improving the international circulation of OF. If many papers are found internationally 5–10 years after their publication in OF, then OF is too poorly known. (We do not hazard the alternative interpretation that OF has published high-quality papers on topics that have become fashionable elsewhere ten years later.) This clearly is a challenge. There are objective reasons for trying to improve the communication with OF's international readership in every possible way. Why should papers in OF, like good Irish whiskey, take 12 years to mature?

We have not compared OF with other journals, nor have we examined the importance of OF among ornithological journals as measured by the number of citations in different journals. Antti Halkka (pers. comm.) has, however, calculated the impact factor of OF in 1984 (the average number of citations in 1984 to OF-papers published in 1982–83). The result was that OF would have ranked among the 6 to 8 top ornithological journals listed in the SCI. This is remarkable, as international citations by foreign authors to papers in OF show a clear time lag, but, on the other hand, citations by foreign authors otherwise comprise the bulk of citations to OF-articles in the SCI.

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Selostus: **Kuinka Ornis Fennicassa julkaistuihin artikkeleihin viitataan kansainvälisissä sarjoissa?**

Tutkimme Ornis Fennicassa vuosina 1963–82 suomalaisten kirjoittajien julkaisemien artikkeleiden vuosina 1983–86 saamien siteerausten määrää kansainvälisissä sarjajulkaisuissa (lähteenä *Science Citation Index*). Kirjoittajien siteerauksia omiin artikkeleihinsa emme ottaneet mukaan. Liki puolet artikkeleista oli sellaisia, joihin ei viitattu lainkaan. Teoreettisiin ja käyttäytymis- ja evoluutioekologisiin artikkeleihin viitattiin vähintään kymmenen kertaa useammin kuin kansallisten tutkimusohjelmien yleiskatsauksiin tai yksittäisten lajien levinneisyyttä käsitelleisiin artikkeleihin (kuva 1). Saksankielisiin artikkeleihin viitattiin vähemmän kuin niiden aihevalikoiman perusteella voisi odottaa.

Suomalaiset ja ulkomaalaiset kirjoittajat viittasivat yleensä samalla tavalla eri aihepiirin artikkeleihin, joskin ulkomaiset kirjoittajat viittasivat erityisen usein käyttäytymis- ja evoluutioekologisiin ja teoreettisiin artikkeleihin (kuva 2). Paikallisia ilmiöitä käsitelleisiin artikkeleihin viittasivat enimmäkseen suomalaiset. Erityisen suosittuja suomalaisten viittausten kohteita olivat epätavallisen sään vaikutuksia lintuihin käsitelleet artikkelit.

Suomalaisten ja ulkomaisten kirjoittajien viitteiden ajallinen jakauma oli hyvin erilainen (taulukko 1). Ornis Fennican tuoreet (1978–82 ilmestyneet) artikkelit olivat pääosin jääneet ulkomaalaisilta kirjoittajilta huomaamatta päätellen vähistä viitteistä. Yllättävää oli myös se, että nyt eniten siteerattuihin artikkeleihin alettiin kansainvälisesti säännöllisesti viitata vasta 5–13 vuotta niiden julkaisemisen jälkeen. Tämä on kohtuuttoman pitkä viive. Toisaalta moniin artikkeleihin viitataan ilahduttavan runsaasti vuosikymmeniä niiden julkaisemisen jälkeen.

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