

Trends in applied ethological research: a bibliometric survey of references gathered in *Animal Behavior Abstracts* (1984-1989)

F. Guillén-Salazar

Apdo. 34

46130 Masamagrell, Valencia, España (Spain)

ABSTRACT. *Trends in applied ethological research: a bibliometric survey of references gathered in Animal Behaviour Abstracts (1984-1989).*— In this work bibliometric techniques are used to analyze all the references gathered under «applied ethology» in *Animal Behavior Abstracts* during the years 1984 to 1989. The data obtained are used to classify references according to country of origin, authors' workplace, topics covered, type of publication, and taxonomic groups studied. On the basis of this analysis an attempt is made to characterize methods and objectives of applied ethology and assess recent progress made in this discipline.

KEY WORDS. Applied ethology, Bibliometry

Introduction

As is the case with other scientific disciplines, a divorce between basic and applied research is becoming increasingly apparent in ethology. Already in first half of the century, researchers were interested in the practical applications of animal behavior studies (Katz, 1961). The interest of these early workers fostered a growing number of studies in which the theoretical knowledge that had accumulated over several decades of research was applied to economical and social aspects of human life.

The Nobel price awarded in 1973 to K. Lorenz, N. Tinbergen and K. von Frisch in recognition for their contribution to the study of animal behavior was also, albeit indirectly, a recognition of the potential of practical applications of ethology (Horham, 1979). This event also marked the beginning of formal incorporation of courses in applied ethology to programs offered in agricultural, biological, and veterinary

institutes throughout the world (Fraser, 1982).

Applied Animal Behaviour Science (formerly *Applied Animal Ethology*), first published in 1974, was the first journal to deal exclusively with the results of applied ethological research. In 1978, the first World Congress of Ethology Applied to Zootechnics was held in Madrid. Since then, the number of published reports on applied ethology has increased precipitously (Nichelman, 1986).

Ethology maintains ample relationships with other sciences (Hinde, 1982), however, its multidisciplinary character becomes particularly clear in the realm of applied studies (Fraser, 1982) as exemplified by zoo-technical (e.g., Fraser, 1982; Ruwet & Delhaxhe, 1983; Dantzer & Mormede, 1984; Gonyou, 1985; Balph & Balph, 1986; Nichelman, 1986), environmental (e.g., Miller & Gunn, 1979; Liberg, 1984; Blanco, 1988), veterinary (e.g., Mathews, 1984; Reid et al., 1984; Wright & Nesselrote, 1987), and pest control (e.g., Brunner & Coman, 1983; Wall, 1984; Wall & Perry, 1987) applications of ethological research.

The rapid increase in the number of applied ethological studies in recent years has afforded this young discipline complexity and maturity. It is already possible to characterize its methods and objectives.

Material and Methods

The aim of the present study is to assess progress in the field of applied ethology through bibliometric analysis. To my knowledge, bibliometric techniques have never been used in the field of applied ethology, yet this kind of analysis has produced interesting results in other areas of knowledge (López Piñero, 1972). The publication selected as a source of data was *Animal Behavior Abstracts* (ABA), the only repertoire of references available at present in the field of animal behavior science. Every reference included under the heading «applied ethology» in ABA during the years 1984 to 1989 has been analyzed, using standard bibliometric procedures (Carpintero & Peiró, 1981). The data obtained were then used to create a classification (frequency distribution) of references according to their country of origin, authors' workplace, topics covered, type of publication, and taxonomic groups studied.

Results and Discussion

The results are summarized in tables I-V and in figures 1-3. Between the years 1984 and 1989 ABA included a total of 556 references dealing with aspects of applied ethology.

Type of publication

Most references in applied ethology (87.94%) correspond to articles published in technical journals. The rest (12.06%) were abstracts of presentations at scientific meetings, book chapters, etc. (table I). Of the 145 journals indexed by ABA, 14 contribute with almost half (48.09%) of the references dealing with

TABLE I. Type of publication.
[Tipo de publicación.]

Year	articles	others	total	%
1984	63	5	68	12.23
1985	58	13	71	12.76
1986	78	20	98	17.62
1987	116	8	124	22.30
1988	110	6	116	20.86
1989	64	15	79	14.20
Total	489	67	556	100

topics of applied ethology. This indicates a strong specialization of periodical publications (table II). *Applied Animal Behaviour Science* publishes around a quarter of all published references in applied ethology (22.66%), setting it in the first place in the ranking of publications dealing with applied ethology. Thus, this journal is a «must» for anybody concerned in applied ethology. It is interesting to note that not every article published in *Applied Animal Behaviour Science* between 1984 and 1989 was collected under the heading «applied ethology» by ABA. This indicates that criteria for identification of applied ethological research are poorly defined.

Country of Origin

Table III shows a classification of references by country-of-origin. The United States emerges as the unquestionable leader with 39.74% of the production. Under the heading «others», countries which altogether contributed 19.96% of the references analyzed are included. A total of 44 countries made up the sample, suggesting that interest in applied ethology is geographically widespread.

Figure 1 shows a distribution of references by language, english being the most important. However, the preponderance of english is not only due to higher

TABLE II. The most productive journals.
[Revistas más productivas.]

Journal	articles	%	cum. freq.
<i>Appl. Anim. Behav. Sci.</i>	126	22.66	22.66
<i>J. Econ. Entomol.</i>	29	5.21	27.87
<i>Entomol. Exp. Appl.</i>	16	2.87	30.74
<i>Zoo. Biol.</i>	18	3.23	33.97
<i>Environ. Entomol.</i>	15	2.69	36.66
<i>J. Chem. Ecol.</i>	11	1.97	38.63
<i>J. Wildl. Manage</i>	9	1.61	40.24
<i>J. Anim. Sci.</i>	8	1.43	41.67
<i>J. Appl. Entomol.</i>	7	1.25	42.92
<i>Mod. Vet. Pract.</i>	7	1.25	44.17
<i>Austr. Wildl. Res.</i>	6	1.07	45.24
<i>Poult. Sci.</i>	6	1.07	46.31
<i>Fla. Entomol.</i>	5	0.89	47.20
<i>Grass Forage Sci.</i>	5	0.89	48.09
Others	288	51.79	100.00
TOTAL	556	100	

TABLE III. Country of origin.
[País de origen.]

Country	articles	%	cum. freq.
USA	221	39.74	39.74
UK	53	9.53	49.27
Australia	41	7.37	56.64
Canada	35	6.29	62.93
The Netherlands	23	4.13	67.06
India	22	3.95	71.01
Italy	20	3.59	74.60
FRG	19	3.41	78.01
Others	122	21.93	100
TOTAL	556	100	

productivity of english-speaking countries (mainly USA and UK) as compared to non-english speaking countries, but also to biases in the selection of journals indexed by ABA. These biases pose constraints on bibliometric analyses in general (Carpintero & Peiró, 1981).

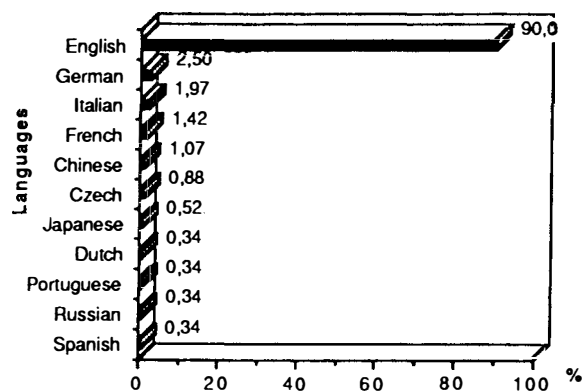


FIGURE 1. Languages.
[Idiomas.]

Authors' Workplace

Analysis of the researchers' workplace allows one to examine productivity from an institutional perspective. The high degree of productivity exhibited by research centers different from universities (52.15% of references) –zoological parks, veterinary clinics, etc.– (fig. 2), may be a consequence of the great applicability of knowledge generated in applied ethological science to problems of immediate social concern. On the other hand, 22.84% of references coming from universities were produced in the USA, being the University of California (19 references) the most productive.

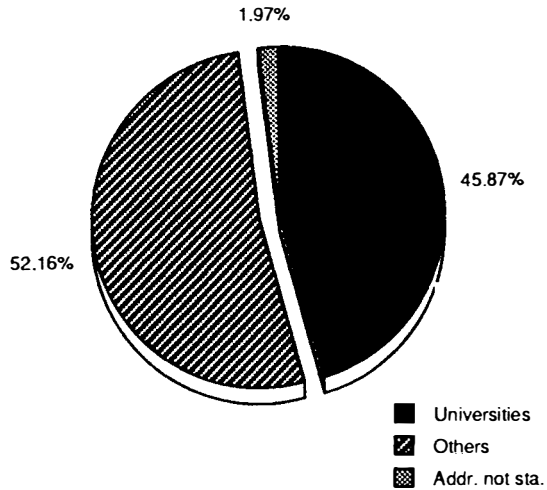


FIGURE 2. Workplace.
[Lugar de trabajo.]

Topics Covered

Analysis of the thematic contents of references collected in ABA is an effective way of knowing the mainstream interests in applied ethological studies. Since there are no universally accepted criteria for classification, my own scheme has developed comprising the following categories: (1) zootechnical applications, (2) pest control, (3) maintenance of wild animals in captivity (zoological parks, laboratories, etc.), (4) veterinary, (5) social uses (selection and training of dogs for the blind, etc.), (6) wildlife conservation and management, (7) fisheries, and (8) others. The classification has been carried out in an exclusive manner (i.e., no item was included in more than one category) (table IV).

Zootechnical applications occupy the first place in interest of specialists in this area, representing 42.44% of references collected. The main zootechnical problems dealt with concern the effects that livestock systems have on yield and welfare of domestic animals, and pest control (37.41%), being the use of

TABLE IV. Topics covered.
[Temas estudiados.]

Topic	articles	%
Zootechny	236	42.44
Pest control	208	37.41
Maintenance in captivity	42	7.55
Veterinary	31	5.57
Social uses	15	2.69
Wildlife	14	2.51
Fisheries	7	1.25
Others	3	0.53
TOTAL	556	100

chemical attractants the subject studied most often in this group.

It would be interesting to perform a more in depth analysis of the areas that make up applied ethological studies, because knowledge of subjects studied by researchers may help identify areas of special interest in this science. In this sense, the data presented here must be complemented with those reported in other bibliometric studies (Guillén-Salazar, 1990).

Taxonomic groups studied

The same classification used by ABA has been used in the analysis of references by zoological groups. This classification assigns references according to a criterion of exclusion that permits the use of only one category by article (table V). Mammals (excluding primates), and insects are the most studied groups, and make up ca. 80% of the references analyzed. Figure 3 shows that bovine cattle occupy the first place (27.84%) within the mammals. Finally, it is important to emphasize that most works carried out with insects deal with different aspects of pest control;

therefore, the insect groups cited most often are generally pest species important from an economical viewpoint.

TABLE V. Taxonomic groups.
[Grupos taxonómicos.]

Group	articles	%
Mammals (excluding primates)	255	45.86
Insects	182	32.73
Birds	66	11.87
Primates	24	4.31
Fish	11	1.97
Invertebrates (excluding insects)	7	1.25
Vertebrates (excluding fish, birds & mammals)	1	0.17
General	10	1.79
TOTAL	556	100

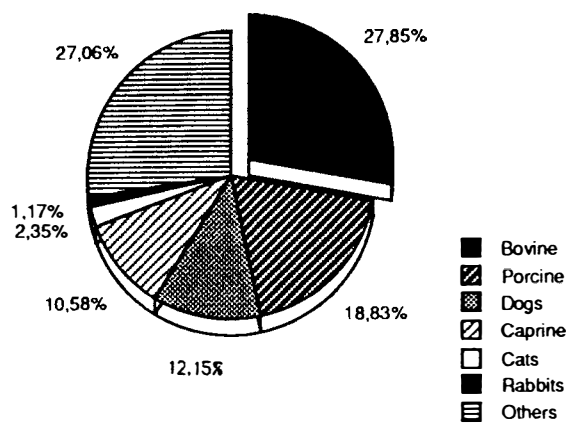


FIGURE 3. Mammals.
[Mamíferos.]

Conclusions

The analysis of references collected in ABA reveals some interesting aspects of current research in applied ethology:

– There is a strong linguistic slant in the selection of references on the part of ABA, slant that favors the english-speaking countries. Yet, the references collected in ABA came from forty four countries, and this demonstrates that interest in applied ethology is geographically widespread.

– The high degree of productivity shown by research centers different from universities may be a consequence of the great applicability of knowledge generated in applied ethological science to problems of an immediate social concern.

– Many of the references analyzed deal with the topics of pest control and zootechnical applications.

Resumen

Tendencias en investigación de zoología aplicada: un estudio bibliométrico de las referencias recogidas en Animal Behaviour Abstracts (1984-1989).

La etología ha separado la investigación fundamental de la aplicada, de la misma forma que lo han hecho otras disciplinas científicas. El rápido incremento del número de trabajos sobre etología aplicada aparecidos en los últimos años han otorgado a esta joven ciencia una importante complejidad y madurez. Resulta ya posible caracterizar sus métodos y objetivos, por lo que es interesante hacer un balance de los resultados conseguidos hasta la fecha.

De entre los diversos métodos que se podían haber elegido con tal fin se ha optado por el camino del examen bibliométrico, que tan buenos resultados ha ofrecido en otras áreas del conocimiento. La publicación elegida como fuente de datos es el *Animal Behavior Abstracts*, ya que se trata del único repertorio de referencias existente actualmente en el campo del comportamiento animal.

El trabajo se ha confeccionado recogiendo las re-

ferencias incluidas en la categoría «applied ethology» entre los años 1984 y 1989, ambos incluidos. Los datos obtenidos de dichas referencias han sido analizados atendiendo al tipo de publicación, la distribución geográfica, el lugar de trabajo de los autores, los temas tratados y los grupos zoológicos estudiados. De su análisis se desprenden las siguientes conclusiones:

- Existe un fuerte sesgo lingüístico en la elección de las referencias por parte del ABA, sesgo que favorece al área científica anglosajona. Pese a ello, encontramos una muestra formada por 44 países, lo que pone de manifiesto que el interés por la disciplina está ampliamente extendido a nivel internacional.
- La elevada productividad alcanzada por los centros de investigación no universitarios puede ser una consecuencia de la gran aplicabilidad que los conocimientos generados en este campo científico tienen en la resolución de problemas de interés social inmediato.
- Las cifras aquí presentadas muestran una amplia diferencia numérica en el interés concedido por los investigadores a cada una de las categorías temáticas seleccionadas. Así, son las aplicaciones a los campos zootécnico y de control de plagas las que han recibido una mayor atención.

Résumé

Recherche en zoologie appliquée: étude bibliométrique des références recueillies dans Animal Behaviour Abstracts (1984-1989)

Ce travail analyse les thèmes recueillis sous l'épigraphe «applied ethology» de la revue *Animal Behavior Abstracts* (1984-1989), pour réaliser un balance des résultats obtenus de nos jours par l'éthologie appliquée et pour vérifier ses méthodes et objectifs. Les chiffres obtenues ont été regroupés d'après les niveaux d'analyse suivants: les types de publications, la répartition géographique, l'analyse des institutions, l'analyse des thèmes, les groupes zoologiques étudiés.

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