

**ACOUSTIC PLAYBACK: CONTRIBUTIONS TO
THE STUDY OF ANIMAL COMMUNICATION IN
THE LAST 13 YEARS (1992-2004)**

**PREDVAJANJE ZVOČNIH SIGNALOV: PRISPEVKI
K PROUČEVANJU ZVOČNE KOMUNIKACIJE V
ZADNJIH TRINAJSTIH LETIH (1992-2004)**

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ABSTRACT

Acoustic playback: Contributions to the study of animal communication in the last 13 years (1992-2004)

Two different databases of scientific publications (Zoological Record and MedLine) were studied in order to identify trends in the use of acoustic playback techniques in the last 13 years (1992-2004). The articles that mentioned the use of acoustic playbacks were classified into 5 subjective classes depending on their topic: Physics, Physiology, Descriptive Studies, Applied Studies and Ethology. Within the class Ethology five subclasses were considered: Learning, Predation, Social Structure, Sexual Selection and Territoriality. From each article we recorded the year of publication, the taxonomic group studied, the country of the research team and the language in which the article was written. We found that there has been an increase in the number of articles published which use acoustic playbacks especially in the class Ethology. The most commonly studied taxonomic group is birds, and although there are research teams from many countries, in number of articles research teams from the USA are clearly dominant.

Key words: Bibliometric review, playback, acoustic communication.

IZVLEČEK

Predvajanje zvočnih signalov: prispevki k proučevanju zvočne komunikacije v zadnjih trinajstih letih (1992-2004)

Avtorji so pregledali dve zbirki podatkov o znanstvenih publikacijah (Zoological Record in MedLine) da bi ugotovili načine uporabe predvajanja živalskih zvokov v zadnjih 13 letih. Članke, ki so omenjali predvajanje zvokov, so vsebinsko razdelili na naslednje skupine: fizika, fiziologija, opisne študije, aplikativne raziskave in etologija. V okviru etoloških člankov o vedenju živali so upoštevali naslednje teme: učenje, predacijo, socialno strukturo, spolno selekcijo in teritorialnost. Za vsak članek avtorji navajajo leto objave, sistematsko skupino živali, državo piscev raziskave in jezik, v katerem je članek napisan. Ugotovili so, da narašča število člankov, pri katerem so raziskovalci uporabljali predvajanje zvoka, še posebno na področju etologije. Največ so raziskovali ptiče, in čeprav so v seznamu avtorji iz mnogih držav, število člankov ameriških avtorjev močno prevladuje.

Ključne besede: bibliometrični pregled, predvajanje zvoka, zvočna komunikacija.

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INTRODUCTION

Playback is a technique in which a natural or artificial signal is played to an animal in order to observe its response (MCGREGOR et al. 1992). In a broad term, there can be as many types of playbacks as sensory systems of the experimental individual but traditionally, playback experiments have been mainly performed with the transmission of acoustic signals. As a matter of fact, the first historical test was an acoustical playback made by R.L. GARNER (using the Edison's phonograph) in the 19th century, even before the invention of the gramophone, in a trial to decipher the “language of the monkeys” (HOPP & MORTON 1998). In spite of this early beginning, the use of acoustic playbacks only became popular in the second half of the 20th century, particularly after the appearance of the first high fidelity portable recorders that allowed the performance of experiments with animals in their natural habitat (FALLS 1992). In the last years with the development of computer science it has become even easier to record, edit and manipulate digitized sounds, making it possible for almost anyone to design experiments involving acoustic playbacks. Here, we present a bibliometric review of articles that used acoustic playback in their methods in the last 13 years (1992-2004) in order to identify tendencies of how acoustic playback has contributed to the study of animal biology. The specific goals were to (1) determine in which fields of animal biology acoustic playback has been preferably used, (2) if there has been an increasing or decreasing trend in the use of acoustic playback in the last 13 years, (3) the taxonomic groups studied with the use of acoustic playbacks, and (4) the most productive countries and the preferred language of publication.

MATERIAL AND METHODS

The main database consulted for this work was Zoological Record. It was supplemented with MedLine due the fact that during an early stage of the review we noticed a significant lack of articles, especially biomedical studies, when only consulting Zoological Records. In Zoological Records we made a broad search between 1992 and 2004 with the terms “playback” AND “not video” in any field. MedLine includes a much larger number of publications per year so the search terms were more specific: we used a category given by MedLine “Vocalization-Animal” in combination with “Playback” in any field between 1992 and 2004.

From the results obtained we recorded the journal, language, institution, country and the taxonomic group they worked with. Based on the terms and descriptors given by both databases, as well as the abstract when possible, the articles were classified into 5 subjective classes: Physics, Physiology, Descriptive, Applied and Ethology. The class Physics included articles that studied any aspect of the physical properties (e.g. sound transmission in its habitat) of animal calls. The class Physiology included the articles that studied neural and hormonal mechanisms involved in auditory processing. The articles that described the calls of animals in response to acoustic playbacks were included in the class

Descriptive. The class Applied included articles in which acoustic playbacks had been used for censusing, pest control and to study the effect of acoustic contamination in behaviour of animals. Finally, the articles in the class Ethology were also subdivided into five subclasses depending on their topic: Learning, Predation, Social Structure, Territoriality and Sexual Selection.

All classes and subclasses were exclusive, with no studies included in two or more of them.

RESULTS AND DISCUSSION

The total number of articles obtained after discarding repeated entries in MedLine, reviews and methodological articles was of 391. Most of these articles (65.7%) were included in the class Ethology, followed by Applied (18.7%), Physiology (9.2%), Descriptive (5.9%) and finally Physics (0.5%). The total number of articles per class can be found in Fig. 1. Within the class Ethology most of the articles were assigned to the subclass Sexual Selection (28.0%) followed by Social Structure (22.2%), Territoriality (21.4%), Learning (15.9%) and finally Predation (12.5%). The total number of articles per subclass can be found in Fig. 2.

When comparing between years, it is clear that the number of articles that have been using acoustic playback has grown since 1992, and in particular, since 1999 this rise has been more dramatic (Fig. 3). We can compare this trend with the total number of articles included in Zoological Records in the same year to see that this increase in the number of articles published that have used acoustic playbacks is independent from the total number of articles included in the database (Fig. 4). In Fig. 5 we separate the articles in the classes defined and we see that the significant raise is in the class Ethology. Inside the class Ethology we find that until 1999 there are no large differences in trends between subclasses (Fig. 5). After 1999 the dominating subclass is Territoriality but only until 2001 when articles on the topic of Sexual Selection are higher in number. The decrease in number of articles using acoustic playbacks between 2003 and 2004 could be due to the fact that there are actually less articles in the last two years revised, but this is more likely due to the fact that those years were not completely indexed at the moment of this bibliographical study. This hypothesis is supported by the fact that the total number of articles included in Zoological Records also show this decreasing trend between 2003 and 2004 (Fig. 4).

If we classify the articles obtained by taxonomic groups we can see that the animals that are more commonly studied when using acoustic playbacks are the birds (Fig. 6). Birds are probably the most intensively studied vertebrates from an acoustic point of view, but in terms of the number of different species, arthropods and insects in particular are by far the most successful group of animals and many of them rely heavily in acoustic communication so in a way it is surprising that only 6% of the articles reviewed worked with this group. When reviewing the total number of articles included in Zoological Record between 1992 and 2004 (859303) we observe that only 13.2% of them are dedicated to

birds (113451), while 22,6% are about insects (194309). It is also surprising to notice the lack of any article about reptiles while at least 1% worked with fish. Within classes we find that in almost every class birds is still the preferred taxonomic group. The exception is the class Physics where there are the same number of articles with birds and with mammals, in particular bats (Fig. 8). In the class Descriptive we only find articles with birds and anurans, although in this review, as we searched for those that used acoustic playbacks, we most likely missed most of these type of papers. The only class in which we find articles with all five taxonomic groups is Ethology.

We assigned the nationality of each article based on the country of the home institution of the corresponding author. The country with most number of articles published was USA, but 35 different countries have published articles in which acoustic playbacks have been used (Fig 9). This large number of countries gives an idea of how generalized this technique is worldwide. Although research teams from many different places of the world appeared in our review, most of the articles found were written in English (Fig 10). The few that were written in other languages normally were applied studies where they used playback for monitoring local areas.

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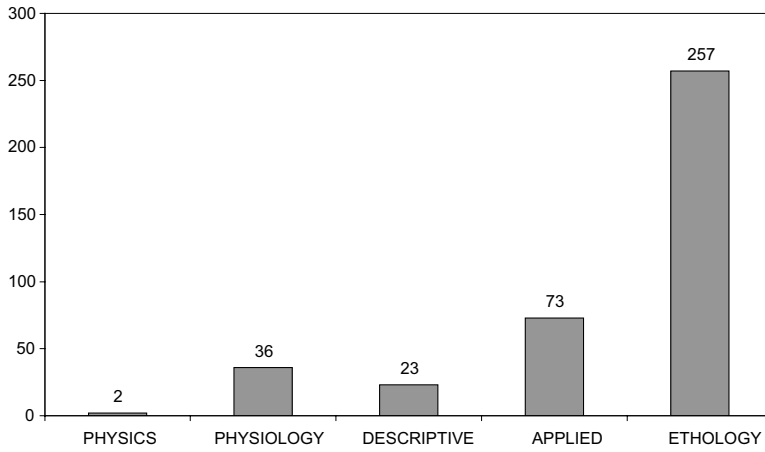


Figure 1: Total number of articles per class (1992-2004).

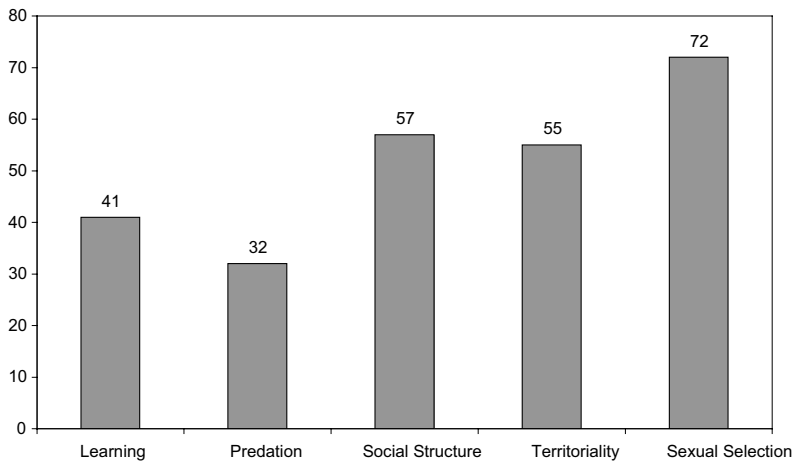


Figure 2: Total number of articles in the class Ethology per subclass (1992-2004).

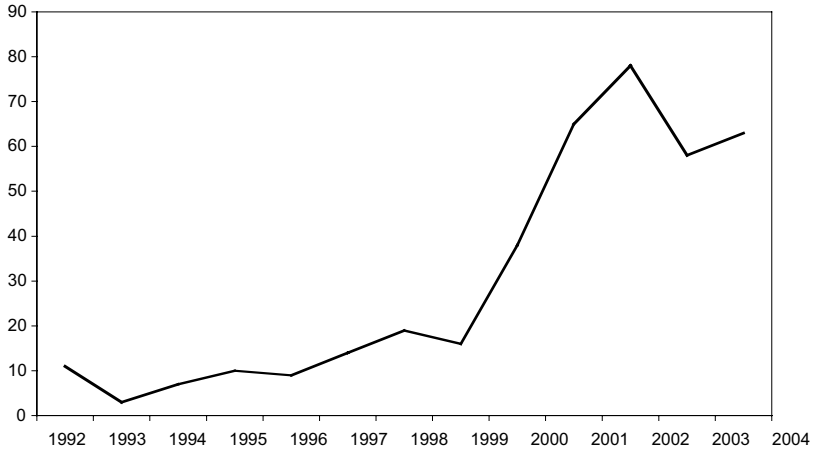


Figure 3: Total number of articles using acoustic playback between 1992 and 2004.

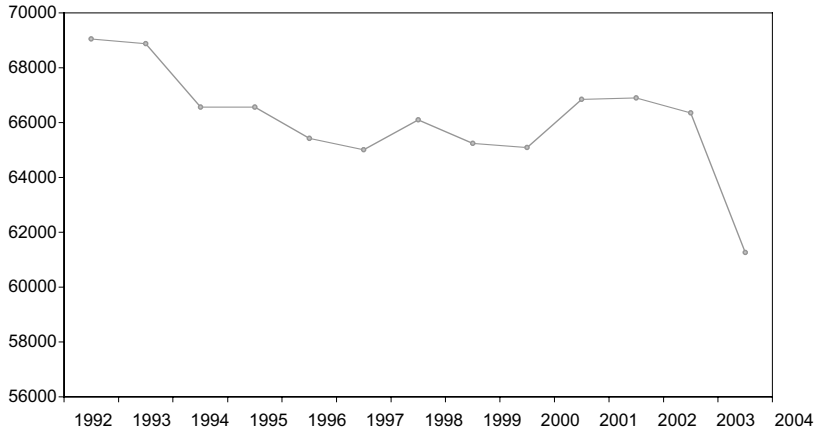


Figure 4: Total number of articles included between 1992 and 2004 in Zoological Records.

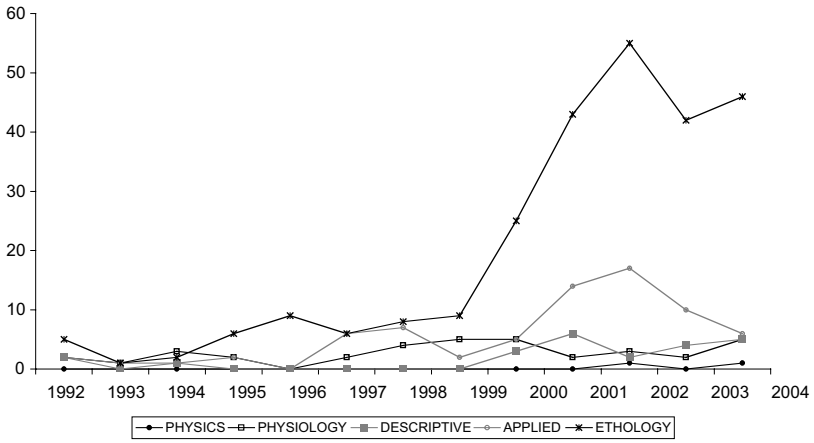


Figure 5: Total number of articles per class between 1992 and 2004.

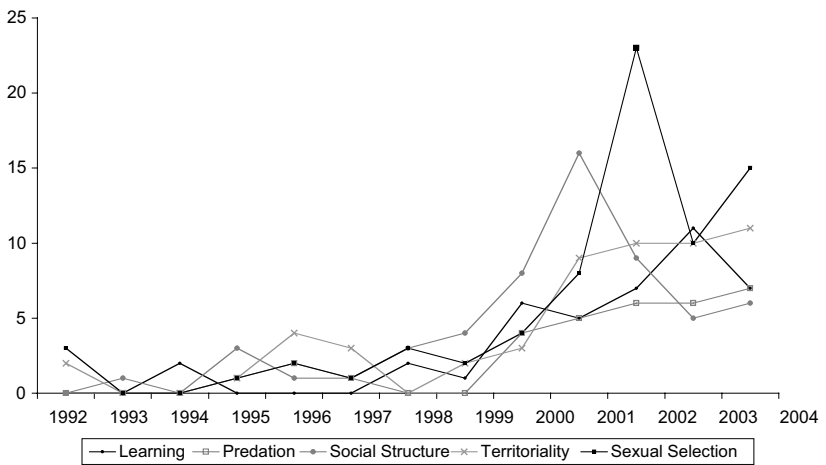


Figure 6: Number of articles in the class Ethology per subclass between 1992 and 2004.

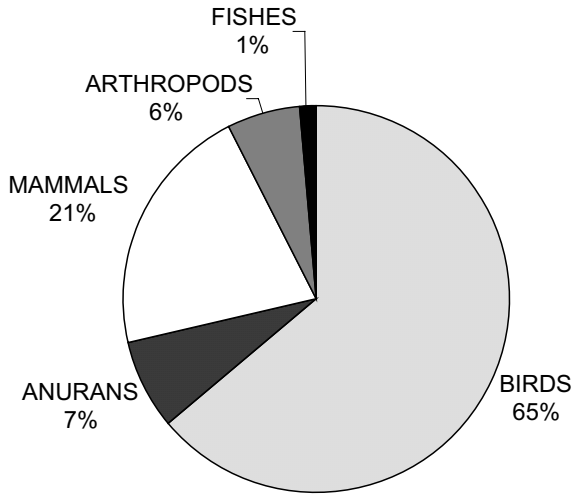


Figure 7: Percentage of articles per taxonomic group studied.

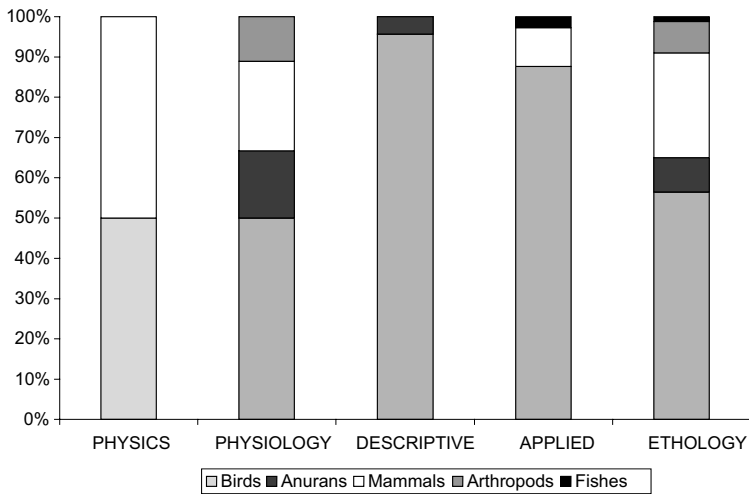


Figure 8: Percentage of articles dedicated to each taxonomic group within each class.

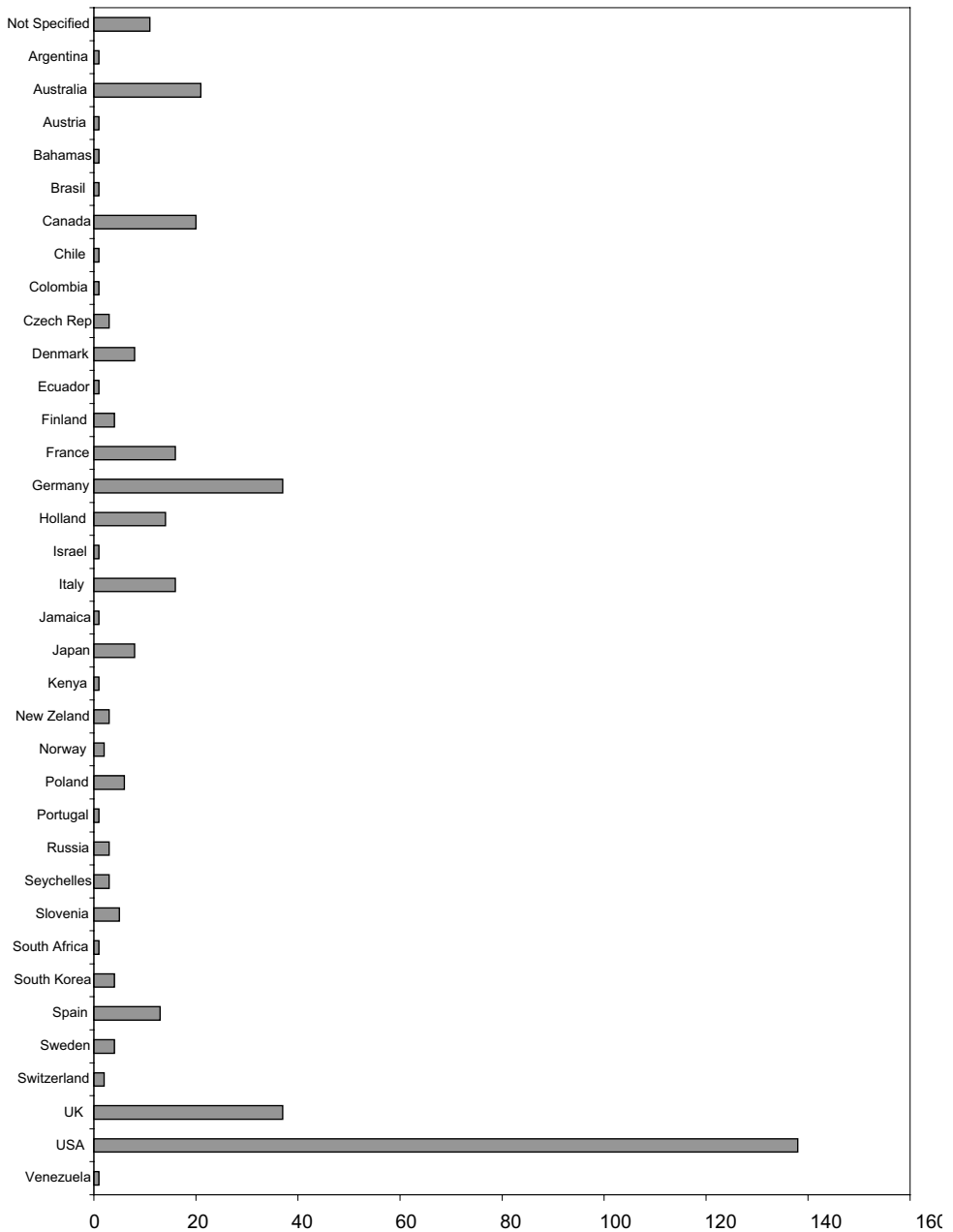


Figure 9: Total number of articles using acoustic playback per country of the home institution of the corresponding author between 1992 and 2004.

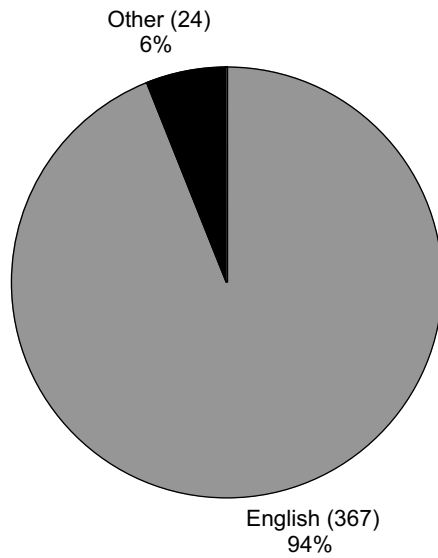


Figure 10: Number and percentage of articles that used acoustic playback written in English between 1992 and 2004.