

# **EFFECTS OF SOUND POLLUTION ON FAUNA: A BIBLIOGRAPHIC REVIEW**

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**Abstract:** This study aimed to analyze and compile the damage caused by the sound of fireworks, wind farms and environments close to large cities to wild and domestic animals and flora. In order to do so, a bibliographic review was carried out with topics involving noise pollution, Resolution 001 of the National Council for the Environment (CONAMA), changes caused by the sound of *Serinus canarius* (canary), pollution caused by wind farms, wildlife and diseases caused by noise pollution in domestic animals. It was concluded that there are several evils caused by noise pollution to the biota, however, there are few studies carried out on this subject. As a result of this fact, research must be encouraged mainly when considering that human beings need to relate harmoniously with other beings, in search of strategies for less diffusion of noise pollution, reconciling sustainable methods with less environmental impact. Keywords: bird migration, wind farms, damage, domestic animals.

## INTRODUCTION

In order to expand the life opportunities of human beings, the search for economic development has intensified over the years. The consequences of this model are the environmental impacts, which before seen from the perspective of progress, since the last century have become a target of growing concern. Such concern has given rise to several attempts to switch, mainly, from the energy matrix of fossil fuels to the so-called green energies. Among some efforts is the

Incentive to Alternative Sources of Electric Energy (Proinfa), created by Law No. 10,438/2002, which aims to increase the share of alternative renewable sources (small hydroelectric plants, wind farms and biomass thermoelectric projects) in the production of electricity. In this sense, wind energy stands out, which has several positive aspects, and,

however, some research has pointed out that the noise caused by wind farms causes changes in the migratory route of birds. The discussion in this regard is extremely important, since in Brazil there are 536 wind generating plants producing 13,135,243 Kw (National Electric Energy Agency - 2018).

In the first article in CONAMA resolution 001, of January 23, 1986 (BRASIL, 1986), the definition of environmental impact is presented as “any change in the physical, chemical and biological properties of the environment, caused by any form of matter or energy” resulting from human activities” that directly or indirectly affect, among other items, the biota.

Gerges (1991) stated that sound and noise are the same physical phenomenon, however they are not synonymous. A noise is just one kind of sound, but a sound is not necessarily a noise. From a psycho-acoustic point of view, noise would be an unpleasant sensation caused by acoustic energy (Apud DREOSSI & MOMENSOHN-SANTOS, 2015).

More than 75% of the earth's surface has been modified by human activities (ELLIS, 2008). To the detriment of these changes, noise pollution is not restricted to the terrestrial environment, impacting the entire biota that coexists with human activity.

The development of the way of life of humans is largely responsible for noise pollution: cities with more and more industries, roads and railways that cut through much of the country. At this point, it is necessary to think that the animals that suffer the most are the domestic ones because they are inserted in this environment and here some damages caused to the roller canary (*Serinus canarius*) are presented.

The objective of this work was to identify, in the existing literature, the damages resulting from noise pollution in domesticated animals such as *Serinus canarius* (roller canary) and

wild animals such as *Procyon lotor* (raccoon) and *Gasterosteus aculeatus* (leaf fish).

## MATERIALS AND METHODS

This work was carried out from a bibliographic review of scientific articles in Google Scholar databases, Scientific Electronic Library Online (SciELO) and ResearchGate Portal. The keywords used were: bird migration, wind farms, damage and domestic animals. Articles were sought that explained the connection between noise and harm caused to fauna (domestic and wild animals) and flora.

After reading several articles, 11 were selected for meeting the purpose of this study. They present studies related to: wind energy and behavioral interference in birds, reproduction and feeding of these; impacts of fireworks on domestic animals; influence caused by an area with high noise level near an airport on *Serinus canarius* birds; survey of behavioral changes in wild rats in an area near a wind farm, in addition to the importance of birds in seed dispersal.

## RESULTS AND DISCUSSION

Throughout this bibliographic survey, a counterpoint stands out: while a vast number of publications focused on the impact of noise pollution on human health were available, this also does not occur for fauna and flora. It was difficult to find publications focused on the impact on animals and plants, with emphasis on the flora, since the works found deal with the problems caused in seed dispersal due to the behavioral change of birds and mammals. The fact is that there are some publications with little scientific merit, therefore less reliable and more difficult to prove. It was also observed that the behavioral reactions of certain individuals of different species when exposed to noise, noise and vibrations were different. In the majority, individuals

with greater sensitivity to sudden changes were affected more drastically, demonstrating behavioral changes of greater aggression in female birds and greater abandonment of nests and eggs, which occasionally resulted in the decline of individuals in the population (SILVA & APOLINÁRIO et al, 2001).

Studies have also confirmed the occurrence of species leakage from areas impacted by these changes, generating overpopulation of other individuals. It was possible to notice that some prey are more likely to survive in areas of noise pollution, due to the sensitivity shown by predators (FRANCIS et al., 2009).

With the purpose of compiling the results presented in the articles studied, the way in which species subjected to noise pollution behaved is presented below (Table 1).

H. Fredrick and Y. Jessica (2016) stated in their study that females of the *Pavo cristatus* species exposed to high levels of noise during the night period showed no change in risk perception and behavior. However, there was a distance from predators, which began to avoid the area subjected to noise. The authors conclude by stating that long-term research must be carried out to ratify the study. In the same study, the authors detected that *Procyon lotor* and *Felis catus* indirectly modified their eating habits, as they avoided the areas in which the *Pavo cristatus* nest during the nights with noise pollution.

L. Rafal and P. Kajetan (2018) conducted a field study with *Cricetus cricetus* (endangered species) in Poland, near three wind farms, in which three hamster burrow points were accounted for. The first burrows were present at about 150 meters from the wind farm turbines, the second point of the burrows was located at an intermediate distance of about 200 to 500 meters, the third region was outside the wind farm land in a space of 1 to 5 kilometers. The result of the study proved that there was no change in the housing or behavior

| Authors                                       | Species analyzed                   | Observed behavior                               | Interference                            |
|---|------------------------------------|---|---|
| H. Fredrick e Y. Jessica (2016)               | <i>Pavo cristatus</i>              | Selection of night rest places                  | None                                    |
| Silva, José e Apolinário, Marisa et al (2001) | <i>Serinus canarius</i>            | Reproductive behavior Nest abandonment          | Significant impact presented in females |
| H. Fredrick e Y. Jessica (2016)               | <i>Pavo cristatus</i>              | Night Vigilance Levels / Perception of risk     | No significant impact                   |
| L. Rafal e P. Kajetan (2018)                  | <i>Cricetus cricetus</i>           | Spatial distribution of the species             | None                                    |
| H. Fredrick e Y. Jessica (2016)               | <i>Procyon lotor e Felis catus</i> | predatory behavior                              | Extremely impacted                      |
| A.R. Dale, J.K. Walker et al (2010)           | <i>Canis lupus familiaris</i>      | behavior and fear levels                        | Extremely impacted                      |
| A.R. Dale, J.K. Walker et al (2010)           | <i>Felis catus</i>                 | behavior and fear levels                        | intense impact                          |
| C. Alexander, F. Clinton et al (2012)         | <i>P. edulis</i>                   | Interference in seed dispersal (indirect cause) | moderate impact                         |
| P. Julia e R. Andrew (2011)                   | <i>Gasterosteus aculeatus</i>      | hunting efficiency                              | Impacted                                |
| S. Andrea e S. Björn (2010)                   | <i>Myotis myotis</i>               | hunting efficiency                              | Impacted                                |

Table 1. Survey of impact on species habits by author.

of the hamsters, regardless of the distance from the den group. As a final discussion, it was identified as preferable for the *Cricetus cricetus* species to remain close to the wind farm, since this is an endangered species, and moving them could pose a greater risk to their survival.

AIR. Dale, J.K. Walker et al (2010) concluded, through questionnaires submitted to the owners of domestic dogs and cats, that the effects of noise pollution caused by fireworks are extremely harmful to *Felis catus* and *Canis lupus familiaris*, with the latter suffering with greater intensity. In the study, 46% of the owners who responded to the questionnaire reported that the domestic animals showed a noticeable level of fear and behavior change when subjected to noise, and 6% of these owners reported that the domestic animals suffered physical harm under such conditions. As a long-term result, frightened animals that were comforted by their owners had an even more negative impact when they were again subjected to the noise of fireworks.

C. Alexander, F. Clinton et al (2012) carried out their study in New Mexico, near an oil well, which have compressors emitting amplitudes greater than 95dB, in which they analyzed the interaction of the ecosystem, specifically the dispersion of the seeds of the species *P. edulis* carried by birds. The specific locations where the study took shape were chosen so that it was 40 meters from the oil well station and under a mature tree of the *P. edulis* species. One of the most influential species in seed dispersal of the *P. edulis* species is *A. californica*, which showed an aversion to moving to environments with high noise levels. Thus, another indirect impact was attributed to noise pollution, having the ability to drastically reduce the number of *P. edulis* trees, causing a disturbance in ecological relationships.

Silva, José and Apolinário, Marisa et al

(2001) in their study stated that females of the *Serinus canarius* species that lived near the Guararapes International Airport-Pernambuco showed rejection of most mating attempts and extreme agitation, together with a greater number of nest absences after laying eggs resulting in an 80% decrease in hatchlings.

P. Julia and R. Andrew (2011) show in their article that animals of the species *Gasterosteus aculeatus*, when exposed to environments with the addition of noise, had difficulty in feeding, given that their ability to discriminate between food items and non-food items was reduced, and they conclude stating that it is extremely beneficial to examine the subtle effects of noise exposure, as these have important implications arising from the response to a wide range of acoustic stimuli.

S. Andrea and S. Björn (2010) report the feeding difficulties of *Myotis myotis* (Early bat) in an area located near a highway. The main result obtained is that close to the highway, the bat search time for food increased dramatically, in this sense it is highlighted that most of the bat's prey are predators and the impact of noise on the feeding performance of bats would have complex effects on the food chain and ecosystem stability.

Regarding the 11 articles used, it is noteworthy that the studies focused mainly on interferences with the habits and health of birds and bats. The reasons for the preference for studying these organisms is their importance for the conservation of forest density and population control of small predators. They perform several ecological relationships with microorganisms, animals and specimens of the Plantae Kingdom, which in turn reduce the interaction with the researched species directly affected by noise pollution, in such a way that the dependent organisms of this species also begin to be at risk of extinction.

## FINAL CONSIDERATIONS

It is necessary to deepen the studies on the subject, in order to expand the existing bibliographic collection on the causes and consequences of noise pollution for the fauna and flora. The awareness that anthropic actions are changing the ways of life in the fauna and development of the flora becomes clearer every year, success has already been achieved that could be even more impactful if efforts are directed towards humanity so that the cited problems are minimized.

Some attitudes are being taken by the government and society, among them is the bill nº 97/17 of the São Paulo City Council, which prohibited fireworks with sound effects in May 2018 with the intention of protecting the elderly animals and autistics from the stress caused by noise. Despite being an advance, the law was suspended by an injunction, as it is

up to the State and the Federation to edit such laws, later Law No. explosions and fireworks, as well as any pyrotechnic artifacts with a noisy sound effect in the Municipality of São Paulo, was enacted by the then acting mayor in the city of São Paulo - capital, aiming to mitigate the impacts on public health as well as the fauna and flora. This is a good sign that legislation is being created for the common good of living beings.

It is then noted that greater demand from the population before public bodies is necessary for actions to preserve collective health and greater altruism towards those who suffer from noise, in addition to a greater incentive in the academic area so that further studies with a focus on this theme are researched and produced.

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