



IMPACT OF SOUND POLLUTION ON ANIMAL AND HUMAN HEALTH

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Abstract: At present, noise pollution is considered as one of the key problems which have numerous detrimental effects on both physical and social environment. Noise menace has negative bearing on both health and environment. Right from the inception of human civilization, noise has always been there but it was never so evident, so ubiquitous, so varied and as pandemic as seen in the first decade of this century. The effect of noise pollution is comprehensive and consistent. Sound pollution or environmental noise, mainly caused by transportation and transport systems like vehicles *i.e.* trains, planes, and machines, music systems, megaphones and industries refers to a sound that is annoying, a nuisance or undesired for the ears and badly affect the activity or behavior of the animal and human life. Animals struggle to adapt to the noisy environment in the urban areas. They have developed a range of adaptive strategies available for mitigating the adverse effect of environment noise on their use of acoustic information. However, these adoptions are at the cost of energetic expenditure, increased risk of predation, or lost opportunity for preening, feeding or mating. Apparent consequences may reduce fecundity rates and ultimately threaten their viability or survival in the urban areas. This article provides an opportunity to understand how anthropogenic noise can affect patterns of animal movement, reproduction, social relations and communications.

Keywords: Acoustic, Animals, Fecundity, Predation, Reproduction, Sound pollution, Urban.

INTRODUCTION

Noise pollution refers to a sound that is annoying, a nuisance or undesired for the ears and that impact the activity or behavior of the animal and human life (Rasool and Balwan, 2020a). At present, noise pollution is considered as one of the key problems which have numerous detrimental effects on both physical and social environment. Noise menace has negative bearing on both health and environment. Right from the inception of human civilization, noise has always been there but it was never so apparent, so ubiquitous, so varied and as pandemic as it is seen in the first decade of this century

(Maheshwari *et al.*, 2020; Rasool and Balwan, 2020a). Noise pollution can be described as any undesirable sound that negatively affects the health and well-being of people and other organisms. The source of most outdoor noise (environmental noise) worldwide is mainly caused by machines and transportation systems and social events. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas. Indoor noise can be caused by machines; building activities, and music performances, televisions etc. Chronic exposure to noise has a significant

impact on people's physical and mental health and well-being. It's estimated that prolonged exposure to environmental noise causes 12,000 premature deaths and contributes to 48,000 new cases of coronary heart disease annually, in Europe alone. In addition, 22 million people here suffer from chronic irritability and 6.5 million from sleep disorders (Peris, 2020).

In this increasingly noisy world, an elaborate understanding on well-being of the pets, domestic animals and wild life is the need of the hour. Buzzing of mosquito, barking dogs or caw of crows in our locality may be exceedingly disturbing at times especially when we are in the bed for a nap. Conversely, honking of the vehicles, passing supersonic jet, rock music, roaring street public addressing system and innumerable human noise is obviously nuisance and a stress to the city animals. Cities are dynamic grounds for research on the evolution of animal communication system, with broader implications for conservation in human-altered environment. Noise is regarded as a pollutant majorly because it disrupts the normal hearing sense. According to a World Health Organization

(WHO) finding, noise is the second largest environmental cause of health problems, just after the impact of air pollution (particulate matter).

Scientifically, sounds are mechanical waves of pressure that are transmitted through mediums of solid, liquid, gas or plasma. Generally humans can perceive frequencies between about 20Hz and 20,000 Hz (20 kHz), though this differs depending on humans. Other species (Table 1) such as dogs (45 kHz) and cats (64kHz) hear higher frequencies compared to human while homing pigeons can detect sounds up 200 Hz and extremely low frequencies sounds (infrasound) as low as 0.05 Hz. Natural infra-sounds come from many sources, including weather patterns, topographic features (volcanoes, avalanches, earthquakes etc.), ocean wave activity and cosmic activities (meteorites etc.). A person hears sounds when the vibrations pass through the ear and resonate off the ear drum. Sounds include any noise, music, speech, etc. A noise is a type of sound but is usually used to refer to loud and unwanted sounds.

Table 1: Audible Frequency Range (Hz) of common urban and zoo animals.

Species	Approximate range (Hz)
Goldfish (<i>Carassius auratus</i>)	20-3,000
Cat (<i>Felis catus</i>)	45-64,000
Cow (<i>Bos taurus</i>)	23-35,000
Horse (<i>Equus caballus</i>)	55-33,500
Sheep (<i>Ovisaries</i>)	100-30,000
Rabbit (<i>Oryctolagus cuniculus</i>)	360-42,000
Rat (<i>Rattus rattus</i>)	200-76,000
Mouse (<i>Apodemus sylvaticus</i>)	1,000-91,000
Bat (<i>Myotis spp.</i>)	200-76,000
Dog (<i>Canis lupus familiaris</i>)	67-45,000
House sparrow (<i>Passer domesticus</i>)	675-18,000
Barn Owl (<i>Tylo alba</i>)	200,12,000
Chicken (<i>Gallus gallus domesticus</i>)	125-2,000
American Crow (<i>Corvus brachyrhynchos</i>)	300-8,000
Cockatiel (<i>Nymphicus hollandicus</i>)	250-8,000

Animals and birds use different acoustic signals to maintain and establish contact with the member of the family or social group, as side to navigation, message of distress, presence of food, mating, demarcation of territory and probably many others. Growth in transportation systems, resources extraction, motorized recreation and urban development is responsible for chronic noise exposure in most terrestrial areas, including remote wilderness locations. Animals' acoustic communication must compete with the rapid and dramatic increases in the levels of ambient noise in the urban area. Increased noise levels reduce the distance and area over which acoustic signals can be perceived by animals. This is an area where knowledge of physiology, developmental neurobiology, animal behavior, and behavioral ecology all contribute in understanding how animals adjust (or fail to adjust) to anthropogenic change (Gail and Blickley, 2006; Rasool and Balwan, 2020b). Most researchers agree that noise can affect an animal's physiology and behavior, and if it becomes a chronic stress, noise can be injurious to an animal's energy resources, reproductive success and long term survival (Radle, 1998).

Behavioral Changes in Animals

Animals frequently interrupt their activity to look up and to scan their surrounding environment for potential predators (vigilance). As vigilance and other activities are often mutually exclusive, as such behaviors are at the expense of feeding, sleeping or preening (Randler, 2006). A study on American Crows (*Corvus brachyrhynchos*) revealed that the birds were more vigilant in areas of high human disturbances than in areas of low human disturbances. Prey have evolved anti-predator responses to generalized threatening stimuli, such as loud noises and hastily approaching objects. During encountering disturbance stimuli ranging from the dramatic, low-flying helicopter to the quiet wildlife photographer, animal responses are likely to follow the same economic principles used by prey encountering predators (Frid and Dill, 2002). Some have argued that, similar to predation risk, disturbance stimuli can indirectly affect fitness and population dynamics via the energetic and

lost opportunity costs of risk avoidance. Studies showed strong evidence of reduced densities of many bird species of forest/woodland and open habitat birds in broad zones adjacent to busy roads. The density reduction is related to a reduced habitat quality, and traffic noise that is probably the most critical factor. Intense noise induces an increase of scanning rate and eating speed in rats. In a report it was established that urban European Robins (*Erithacus rubecula*), highly territorial birds reliant on vocal communication, reduce acoustic interference by singing during the night in areas that are noisy during the day. In an another study in West Bengal, India, it was concluded that in spite of heavy noise of trains crowdly travelers, and lack of nest sites, House sparrow (*Passer domesticus*), remain at the railways stations because of availability of food in the nearby roadside market (Ghosh *et al.*, 2010), although there is decline in the population of house sparrow (Balwan and Saba, 2020).

Breeding Behaviours

Bird song is a sexual trait important to attract mate and known to be shaped by environment selection. Acoustic features, including minimum and maximum features, and delivery rate of song notes showed significant differences between habitats in a study conducted on little Greenbul in Central Africa (Slabbekoorn and Smith, 2002). Noisy territories were home to Great-tit males (a common bird species throughout Europe, the Middle East, Central and Northern Asia, and parts of North Africa in any sort of woodland) whose songs had a high average minimum frequency. In quiet territories, birds sing more notes that reaches the lowest frequencies measured in a population observed (Slabbekoorn and Peet, 2003). There are indications of birds having a higher pitched song with frequencies, amplitude and call length, these birds are less susceptible to noise pollution as studied in humming birds (*Lampornis clemenciae*), tree swallow (*Trachycineta bicolor*), nightingales (*Luscinia megarhynchos*), budgerigars (*Melopsittacus undulates*) and zebra finches (*Taeniopygia guttata*), canaries (*Serinus canaria*) paralleling the well-known Lombard effect in humans which is the reflexive increase

in speech intensity during communication in noise (Rheindt, 2003). The adjustment of vocal amplitude may serve to maintain a specific signal / noise ratio that is favorable for signal production (Brumm and Todt, 2002). Similar adjustment of vocal amplitude to counteract masking effect was found in common marmoset (*Callithrix jacchus*), a new world monkey. The amplitude regulation of vocalization contributes to signal transmission distance along with the established relationships between singing behavior, acoustic structure and habitat (Pytte *et al.*, 2003). Another study found a significant reduction in ovenbird (*Seiurus aurocapilla*) pairing success at industrial sites (77%) compares with the noiseless place (92%). These differences were apparent regardless of territory quality or individual male quality. Significantly more inexperienced birds breeding for the first time were found near noise generating compressor stations (industrial sites) than noiseless well pads (48% vs 30%). It was hypothesize that noise interferes with a male's song, such that females may not hear the male's song at greater distance and /or females may perceive males to be of lower quality because of distortion of song characteristics. These works demonstrate that chronic background noise could be important factors affecting bird populations (Habib *et al.*, 2007).

Physiological Changes

There is scientific evidence of reduction or even cessation of milk yield in cow and goats during fright cause by sudden loud sound (Ames, 1974). A tractor engine sound (97 dB) can significantly increase the blood glucose and total leucocyte increase in the blood glucose and total leucocyte count and decreases the level of hemoglobin in milch cow (Broucek *et al.*, 1983). At 105 dB there is reduction of feed consumption, milk yield and release of milk. There is also influence in the hormonal system with increase in plasma 10-OH-corticosteroid level in swine at general noise of 108-120 dB. There is also excess secretion of aldosterone (93dB) and tachycardia (120-135 dB) as evident from the studies on pigs. Sheep expresses higher heart and respiratory rate; lower feeding efficiency and thyroid activity at 90-100 dB white noises (Ames, 1978). Similar finding were record in a study on black buck (Harms *et*

al., 1997). Studies on domestic fowl indicate decrease in weight of chicken (156.3 dB), increase in plasma 11-hydrocorticosteroid (100 dB), interruption of brooding (115 dB) and reduced egg production by keeping hens from feed and water due to noise stress.

Noise deters the productivity of animals both in the wild and domesticated. Cows produce less milk if there is any noise around them during milking. They get agitated and tend to withdraw the milk due to fear and discomfort. Chickens are also adversely affected by noise. There is a drastic drop in the production of eggs for layers in noisy environments.

Neurobiological Affects

Ecological research in the past few decades has made known that most animals acquire and respond adaptively to information that affects survival and reproduction. At the same time, neurobiological studies have established that the rate of information processing by the brain is much lower than the rate at which information is encountered in the environment, and that attentional mechanism enable the brain to focus only on the most essential information at any given time. Data indicates that limited attention affects diet choice and constrains animals' ability simultaneously to feed and attend to predators (Dukas, 2002). Acoustic cues play a role in detection of insect prey by bats and mouse lemur.

CONCLUSION

Noise pollution poses a growing, paradoxically invisible threat. Its effects are already felt both on land and in the oceans. The consequences of the growing noise affect people as well as the rest of nature. The problem is, of course, the biggest around cities, but along with cutting through wilderness with concrete, oceans with ships and cutters, and the atmosphere with airplanes, anthropogenic sounds penetrate almost every corner of the Earth. It's estimated that environmental noise is more and more severe and its intensity will only increase due to progressing urbanization. The ill effect of noise pollution and its implication in human health is well documented. There is notable addition of noise with rapid urbanization. Existence of human and

other biota on the earth is intrinsically associated with the environment and its mechanism. Anthropogenic noise is undoubtedly harming our livestock and city dwelling birds and animals, as evident from a number of research reports.

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