Proceedings of the 3rd International Conference on Biological Engineering and Medical Science
DOI: 10.54254/2753-8818/20/20230783

The effect of light pollution and noise pollution on birds

Jianyi Wang

Shanghai World Foreign Language Academy, Shanghai, 201104, China

20150435116@mail.sdufe.edu.cn

Abstract. It is common knowledge that human society is developing faster and faster nowadays. As human society is developing, the cities are expanding. As the cities are expanding, more and more people are now in the city. To help these people live a better life, more and more resources are produced. After producing most of the products nowadays, there comes pollution. In this way, pollution is getting more and more serious. All of the pollution that is already in a city do not only affect human but also affect birds. One of the most common non pollution is air pollution, almost every city in the world has air pollution. But there are also two other kinds of pollution that is also harming the society and the animals in a serious way. They are light pollution and sound pollution. This passage focuses on these two types of pollution. Light pollution will cause birds to sleep less and may affect their migration way. The birds may be killed halfway on migration way because of the light may lead them to a loss of direction. Sound pollution also reduces the bird sleeping quality. This kind of pollution also cause birds to get food more difficult. By analyzing the effects of these pollution, some ways to help birds may be figured out.

Keywords: light, sound pollution, birds.

1. Introduction

After electricity was discovered mankind had greater productivity, for example lights and alternators were created. The alternators ran day and night creating enough energy to allow humans to use lights whenever they needed to complete their lives, which provided more time for humans to be productive. In this way each person was able to create more value. But with the production of products came pollution. At that time, pollution was mainly focused on air and water pollution. In the last few decades, mankind has realized that two other types of pollution are also caused by human activities, and these are light pollution and sound pollution. Light pollution is defined as light emitted in a direction that has no practical use, or light that is too concentrated or intense for its intended use, or light emitted when it has no reasonable use, or light that adversely affects the ecosystem of insects, wildlife, and humans [1]. In North America, communication towers kill 4 to 5 million birds a year, primarily Neotropical species that migrate at night. the communication tower lights were one of the most important factors causing collisions of birds at night [2]. Noise is derived from the Latin word “nausea” implying ‘unwanted sound’ or ‘sound that is loud, unpleasant or unexpected [3]. If sound is referred to as noise pollution, it is no wonder that it is a sound that can harm humans and animals. Certain animal species, such as songbirds, are particularly susceptible to changes in the soundscape, with studies attributing reduced reproductive success, bird fitness, bird densities, bird community

DOI: 10.54254/2753-8818/20/20230783

richness and diversity, as well as changes to species interactions in urban areas to anthropogenic noise [4]. Over thousands or millions of years, human and animals have developed their own circadian rhythm. Circadian rhythm decides whether creatures should stay awake or sleep at different times of the day. Most humans and some animals naturally stay active during the day and sleep during the night. But a nice sleep requires silence and darkness. Part of the humans and the animals can not enjoy an efficient sleep at night due to the light pollution and noise pollution caused by lights on the buildings or sound from trains or air planes or something else. In this way, they can no longer follow their circadian rhythm. The result turns out to be that those species which cannot follow circadian rhythm began to get sich and breed less. Through this report, effects of both pollutions will be discussed. After knowing the effects of pollutions, human can know how serious the pollutions are nowadays and can think about the solution towards the pollution problem.

2. Light and sound pollution

First of all light pollution has a negative impact on birds. An experiment is carried out at the south face of Tenerife Island on a kind of bird called Calonectris borealis. The Calonectris borealis weigh 600 to 800 grams. The experiment is carried out because some scientists made an assumption due to an observation that thousands of Calonectris borealis are killed because they are attracted by the light created by human and lost their way on the sea. The team chose birds first because among the newly burned birds they were apparently healthy and able to fly great distances. The birds were placed in a cave, a box at an altitude of 900 meters, and the cave was 8 kilometers away from the island. This island is a popular tourism and more than 50% of the young bird that runs aground is found on the island. The birds are divided into three kinds. One with GPS tags, one with tape as a marker, and one as a control group. The government offered help to the research group. They asked the citizens and tourists to watch out for birds that wander around the shore and bring them back to the research team. The research group will check the birds before bringing them back to the sea. For the GPS way, each GPS device weighs 23 grams, which is less than 4 percent of the weight of any young bird. Such a low weight suggests that the GPS will not affect the birds' flight. The tape approach will have a four to five centimeter tape tapped on the back of the bird and a number written on the tape. For the controlled team, although they will not be labeled, but they will be observed as long as the other birds. While 19.5% of the birds carrying GPS stopped flying during the flight, 13% of the birds carrying the tape stopped flying and 8.2% of the control birds stopped flying during the flight. All of the birds found to have stopped flying lost a little weight, with changes in weight ranging from minus one hundred and three to minus five. The research team also analyzed the flight paths of these birds. It turned out that as the light pollution became stronger, the birds tended to fly in a more circuitous manner. From this experiment, it is clear that light pollution does have an effect on birds and affects their flight patterns and ability to discern paths [5]. Another group of researchers that this kind of experiment with petrels. This research group banded 279 birds. A hundred and ten birds from this group is the natural birds that from their breeding colonies, and a hundred and eighty nine birds are those who recovered from rescue. GPS is tied to 63 first flyers and 94 second flyers. Some of the birds failed to arrive at destiny during the task. And according to the satellite. Image. The words the light pollution is the more birds are trapping that place [6].

Another group of researchers found another phenomenon whose results showed that sound and light pollution-dependent birds of worms and worms were more affected than crop-dependent birds. They found that the light pollution lowers the biodiversity of an area and that birds that depended on a wider variety of food were more likely to be negatively affected by light pollution. The team made a hypothesis. They concluded that there was some positive correlation between the number of birds and the amount of food available to them. The reason that light pollution has a negative effect on bird populations is that bugs tend to fly toward the light, so in a given area with strong pollution, bugs tend to congregate around the light, so that there are fewer bugs in rural areas and more bugs in cities. This would reduce the total number of bugs and the number of birds. But the research group also argues that the birds in the city are less affected by the light pollution than the ones in the rural area because,

DOI: 10.54254/2753-8818/20/20230783

as it is said before, there are more bugs in the city. The research team conducted experiments in 14 cities across Europe. They used a number of models to calculate how loud the noise was and also used data collected from satellites to calculate the light pollution in specific areas. It is also thought that some citizens may have the habit of feeding wild birds. This phenomenon can only be accepted because it is impossible to ask citizens to change their habits for the experiment. Their hypothesis proved to be correct after considering all the above mentioned conditions [7].

The research group thought the main reason for the negative effects of light pollution is because the light pollution affects the amount of sleep that birds will have during the night. The birds were divided into two groups, the first group it contained three males and nine females. The second group was exposed to light and contained 11 males and 7 females. The birds that participated in the experiment or wanted to sleep entered the last prepared for them by the research group. The birds slept more than the time they spent in the nest. On the first night, both the control and the lighted group were in an environment without lights, which meant that both groups slept in a similar environment. On the second night, the night and light groups would be turned on and the birds were affected by light pollution. It was found that the LED lights at night forced the birds to leave their nests at an earlier time and they also woke up at an earlier time. Another result was that females tended to sleep better than males, and birds in the light group also took more time to fall asleep [8].

Noise pollution also leads to a decrease in the birds' abilities, especially in predation. Noise pollution also leads to decrease in birds abilities in, especially in predation. The birds that live in a forest near the city is often affected by the noise pollution caused by human. To figure out how seriously the birds are affected as research group carry out an experiment. They put a controlled amount of birds into a place and then put 720 caterpillars into that area. Time. By time they make the noise pollution caused by themselves in that area more serious. The result is that the birds did had some trouble in finding the prey. If the noise pollution is twelve DB louder than original one, the caterpillars are 37.2%less likely to be caught by the birds.

Obviously, the birds are affected by the noise pollution very much. The noise in the forest is usually no more than thirty DB. But in the city the noise is usually above sixty DB, sometimes it may even get to 70DB. And in this case, the birds cannot even catch. 40% of the Praise that they should get. As a result, the amount of birds that live in the forest around the City. Well, soon run out of food and in this way they have to migrate to other places for food. Although noise pollution affects birds, another species is particularly affected by noise pollution. Bats use sound to get their location, and if the sound in the environment rises bats will have a hard time knowing their location and therefore their activity will decrease. Finally, some bats may die of starvation because they cannot find any food.

According to the study for every 2% increase in sound throughout the environment, humans are 19.5% less likely to move around in the environment, which causes a lot of trouble finding food. Some birds usually communicate by chirping, and also most animals are strongly affected by human-caused noise pollution. A portion of the birds are placed near the highway, and the rest are placed away from the highway. Near the highway there is stronger noise pollution, and such birds communicate by chirping. Scholars found that the birds placed near the highway had a higher sound than the birds placed away from the highway. This phenomenon means that the birds there are affected by noise pollution, so they have to communicate through higher sounds in order to survive, and noise pollution causes a lot of damage to the birds' daily communication [9].

One group in Mexico carried out an experiment about noise pollution affects birds. There are mainly two places in the experiment. One of them is around the equipment of gathering natural gases and the other one is far away from this place, which is a lot of quieter. Another factor that causes different kinds of noise pollution is the density of cars on the road. Like in Finland there is the last corner of the road where apparently noise pollution is as unlikely to occur. In this way, birds should live happier in Finland than in a large country. Scientists believe this phenomenon is that noise pollution does not affect birds as strongly as light pollution. However, despite the fact that pollution has fewer negative effects on birds, they are still not negligible [10-12] .

DOI: 10.54254/2753-8818/20/20230783

3. Suggestions

Both light and sound pollution have a lot of negative effects on birds and need to put more attention on the effects on birds and make constructive suggestions. First of all, adding boards to the roadside, as humans are seeking a more convenient way of transportation built more cars. But cars also produce a lot of noise and birds are more negatively affected. By adding wooden panels on both sides of the road, the sound cannot be carried directly into the air, which means that the sound that actually reaches the birds will be weaker, which can highly prevent birds from being affected by noise pollution.

Secondly bird sanctuaries can also be created. Humans are not allowed there unless the birds are suffering from a disease or the plants are dying from the birds. Factories and highways are not allowed to be built on the edge of the area. In this way you can get rid of noise pollution. Protected areas can also be kept away from cities. Light pollution is not in the light shining directly into a place. It is actually light that travels into the air and is reflected back into the air by dust, causing an area of the sky to be brighter than it should be. So an assumption can be made that if there is no excess light at the edge of the area, there will be no light reflecting into the sky.

Also, the bird sanctuary is small compared to the city, but it can provide a better place for birds to live. The third can also build nests for birds. As mentioned earlier, light pollution and noise pollution mainly affect the quality of birds' sleep. Therefore, if better sleep quality is provided for birds, the effect of light pollution on birds can be reduced. It also prevents light from entering directly into the last room. More importantly not only provides a place for birds to get rid of light and sound pollution, it can also be a shelter for birds to live in seasons such as winter or summer, which can help them get rid of extreme weather and birds are more likely to survive the storms.

Finally, also reduce the decorative arts. Skyscrapers in the city have a lot of light panels that are mainly used for advertising or just plain decoration and cause more light pollution. This paper suggests that reducing the use of such lights can greatly reduce light pollution and also save energy for other uses. The call should be to plant more trees, and the place to plant more trees is mainly on both sides of the road. First of all, trees can serve the same purpose as the planks on the road, which provide sound transmission from the road into the air. Secondly, trees can be planted along the road, which will not only prevent the sound from being too loud, but also provide a shelter for birds. It benefits not only birds but also humans.

4. Conclusion

Today, pollution occurs after the production of most products, and all pollution in cities affects not only humans, but also birds. The most common non-pollutions are air pollution, light pollution and sound pollution. Light pollution can cause birds to sleep less and may affect the way they migrate. Birds may be killed during migration because the light may cause them to become disoriented. Sound pollution can also reduce the quality of birds' sleep. Through the experiment that is mentioned above, human activity has caused pollution, and both lights and sound pollution have a lot of negative effects on animals. Some of the birds failed to migrate and some of the others. Failed to finish their daily task. But most of the animals have their own internal clock when they felt to achieve some of the targets during a specific time of the day. Their internal clock is changed. This does not only affect the birds themselves, but also affects other animals. Just think of the birds tweeting all over the night. Not only the birds will sleep less, but human will also face. Worse sleeping quality. So the research made in this passage, we can know that light pollution and sound pollution. Are needed to be reduced by now. The researchers mentioned in this passage mainly focused on the disorder of the birds' activities. But the effects of light pollution and sound pollution on the organs of the birds is still unknown. Do they know this kind of information? More researches have to be done. But anyway, if people reduce light pollution and sound pollution by now, human and birds may both face a brighter future.

References

[1] Kyek, S. J. Light Pollution in Switzerland. An Analysis of Regions and Natural Habitats. Swiss Federal Institute of Technology Zurich, Department of Environmental Systems Science.2009.

[2] Xuebing Zhao, Min Zhang, Xianli Che, Fasheng Zou, Blue light attracts nocturnally migrating birds, The Condor, Volume 122, Issue 2, 5 May 2020, duaa002.
[3] Omar, K., & Elgamal, I. (2021). Conservation of challenging endemic plant species at high risk of extinction in arid mountain ecosystems: a case study of Rosa arabica Crép. in Egypt. Journal of Mountain Science, 18(10), 2698-2721.
[4] Mohan, S., & Raj, S. (2022). Impact of high and low concentration of fly ash amended soil on physico‐chemical properties of biodiesel produced from Jatropha curcas. Environmental Progress & Sustainable Energy, 41(4), e13819.
[5] Arévalo, C., Amaya-Espinel, J.D., Henríquez, C. et al. Urban noise and surrounding city morphology influence green space occupancy by native birds in a Mediterranean-type South American metropolis. Sci Rep 12, 4471 (2022)
[6] RODRÍGUEZ, AIRAM AND RODRÍGUEZ, BENEHARO AND ACOSTA, YARCI AND NEGRO, JUAN J. TRACKING FLIGHTS TO INVESTIGATE SEABIRD MORTALITY INDUCED BY ARTIFICIAL LIGHTS,2022.
[7] Rodríguez, A., Rodríguez, B. & Negro, J. GPS tracking for mapping seabird mortality induced by light pollution. Sci Rep 5, 10670 (2015).
[8] Morelli, F., Tryjanowski, P., Ibáñez-Álamo, J.D. et al. Effects of light and noise pollution on avian communities of European cities are correlated with the species' diet. Sci Rep 13, 4361 (2023)
[9] Raap, T., Pinxten, R. & Eens, M. Light pollution disrupts sleep in free-living animals. Sci Rep 5, 13557, (2015)
[10] Wang, J. S., Tuanmu, M. N., & Hung, C. M. (2021). Effects of artificial light at night on the nest-site selection, reproductive success and behavior of a synanthropic bird. Environmental Pollution, 288, 117805.
[11] NRaap, T., Pinxten, R. & Eens, M. Light pollution disrupts sleep in free-living animals. Sci Rep 5, 13557, (2015)
[12] Clinton D. Francis, Catherine P. Ortega, Alexander Cruz,. Noise Pollution Changes Avian Communities and Species Interactions. Current Biology, Volume 19, Issue 16 (2009)