

## **4. Intensification of Pollution and its Impact on Avian Communities and Migratory Birds**

M. Sinduja<sup>1\*</sup>, V. Sathya<sup>2</sup>, P. Kalpana<sup>3</sup>, B. Balaganesh<sup>4</sup>, M. Maheswari<sup>5</sup>,  
K. Boomiraj<sup>6</sup>, M. Shankar<sup>7</sup>, S. Ragul<sup>8</sup>

### **Abstract**

Birds play important roles in the functioning of ecosystems globally, acting as plant pollinators, spreading seeds, contributing to nutrient cycling and soil formation, and providing crucial chances for people to connect with environment. Unfortunately, the ever-increasing human population's urbanization, agricultural intensification, and industrialization are increasingly taking a significant toll on bird populations. Dwindling bird populations and kinds can have a severe influence on human health, the economy, and food production, therefore protecting the avian community is critical. Bird populations are falling as damaging anthropogenic activity increases. Pollutants emitted into the environment have an impact on the fitness and survival of birds worldwide. Birds in rural and urban areas, as well as seabirds, are under threat and are being exposed to toxic chemicals. Mitigation techniques must be given top importance. Understanding how humans-induced rapid environmental changes (HIREC) affect birds might assist politicians, urban planners, and farmers better conserve birds and the ecosystem services they provide. Thus, the use of birds as bio indicators is

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<sup>1</sup>Technical Executive, National Agro Foundation, Taramani, Chennai, Tamil Nadu.  
*Corresponding author email – seethasinduja@gmail.com*

<sup>2</sup>Environmental Scientist, Tamil Nadu Pollution Control Board, Chennai, Tamil Nadu

<sup>3</sup>Additional Director, National Agro Foundation, Research & Development Centre, Anna University Taramani Campus, Taramani, Chennai, Tamil Nadu

<sup>4</sup>Assistant Professor (SS&AC), Department of Agriculture, Karunya Institute of Technology and Sciences, Coimbatore

<sup>5</sup>Professor & Head, Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu, India

<sup>6</sup>Assistant Professor, Department of Environmental Sciences, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu

<sup>7</sup>Research Scholar, Division of Plant Genetic Resource, ICAR – Indian Agricultural Research Institute, New Delhi

<sup>8</sup>Plant Variety Examination Research Associate (PVERA), PPV&FRA, Ministry of Agriculture, New Delhi

dependent on the features of interest and the resources available for ecological evaluation, which encourages the conservation of bird species for future generations. Despite this, interactions between pollutants are still poorly understood and necessitate more focused study efforts. Threats to avian species and anthropoid pollution are still increasing over time, making mitigation measures a top concern for their preservation. This chapter can serve as a starting point for conservationists and decision-makers to understand the various scopes of threats to bird species.

**Key words:** Anthropogenic, Environmental stress, Habitat fragmentation, Pollution, Birds

## INTRODUCTION

Extinction of birds has increased massively in the last 50 years. It is vital to investigate the causes of decline and to find potential solutions to mitigate extinction. It is known that human-made pollution and contamination such as noise pollution, air pollution, oil pollution, plastic pollution, heavy metals, radioactive substances, pesticides and medicines etc. have deteriorative effect on birds. Large-scale research suggests that air pollution, specifically ozone layer depletion, is linked to the losses in bird abundance in the United States and other countries (Sanderfoot et al., 2017). The publications claim that over the past several decades, poor air quality has caused a decline in bird numbers and the loss of 1.5 billion birds worldwide (Puasa et al., 2021).

Anthropogenic pollution is becoming more widespread in all eco systems around the planet. Many taxa, such as birds, have suffered unfavourable consequences in recent years. Additionally, air pollution can harm birds by altering their habitats, causing an increase in parasites, and reducing their food availability (Hornfeldt and Nyholm, 1996). Small migratory birds, which make up to 86 per cent of all terrestrial bird species and include sparrows, warblers, and finches, are most harmed by ozone pollution. Ozone pollution damages birds' respiratory systems directly and causes adverse indirect affects to their food sources (Liang et al., 2020). Long-term pollution exposure in birds resulted in decreased egg production and hatching, lung failure, inflammation, and smaller bodies. Plants that bird depends

on for food, a place to nest, and shelter are damaged by ozone. These contaminants interact, and their combined effects can be more harmful than their individual ones. However, interactions between pollutants are still incompletely understood, prompting more focused study efforts. High priority must be accorded for the preservation of these species is the

## TYPES OF POLLUTION

### *Plastic Pollution*

Most studies addressing the effects of plastics with European and North American origins are found in peer-reviewed publications, followed by Australia and New Zealand (21%), India (18%), and South Africa (8%) (Lebreton et al., 2017). Seabird consumption of plastic has been used to gauge the level of pollution in the marine environment. However, it is also possible to monitor the plastic contamination and bird exposure in faeces, litter, pellets, or regurgitated materials (Provencher et al., 2018). According to Basto et al. 2019's research, up to 78 percentage of recognized seabird species have been found to have Micro plasticin their digestive tracts since the 1960's, and by

- ❖ Passage of the food into intestine.

implementation of mitigating measures due to the ongoing escalation of anthropoid pollution and threats to bird species (Nekaris et al., 2020). This chapter focuses on providing a foundation for decision-makers and conservationists to understand the various types of risks that bird species face.

2050, more than 99% of the more than 300 seabird species are predicted to have consumed plastic debris. In few studies, the level of exposure has been linked to weather conditions, seasonal fluctuation, and species habitat. Wetlands, urban areas, and inland migratory species were only mentioned in 11% of study; the majority of studies focused on marine birds. (Faaborg et al., 2010). Given that freshwater locations are among the most endangered environments, research on freshwater plastic pollution may be expanding, (Blettler et al. 2018).

### *Effects of Plastic Pollution on Marine Birds*

- ❖ Obstruction of the gastrointestinal and subsequent
- ❖ Blockage of the gastric enzyme secretions

❖ Diminished feeding stimulus

❖ Delayed ovulation and reproductive failure

### ***Air Pollution***

In densely populated places, poor air quality caused by pollution and toxic chemicals can drastically affect the bird population. In addition to causing habitat alterations, parasite growth, and reduced food supplies, air pollution can also impact birds (Hornfeldt and Nyholm, 1996). As a result, phytophagous insects have less access to plant carotenoid levels, which can be suppressed by emissions (Gilg et al., 2021). Combined with their extremely high respiratory rates, birds are even more vulnerable to airborne contaminants and pollution (Rutkowska et al., 2018). Climate change brought on by global warming has resulted in extreme weather, unpredictable weather, and disruption of bird migration patterns. Poor air quality in densely populated places, kills birds, causes respiratory ailments, and has a negative impact on bird population (Mitra et al., 2011). Smog impairs visibility, irritates the senses, and diverts the birds from their migratory routes.

### ***Water Pollution***

Leaching of pesticides and heavy metals into rivers, lakes, and

streams, would infect and kill birds. Water pollution, caused by eutrophication can reduce the level of oxygen in the water, threatening lives in the water bodies, (Kumaraswamy et al., 2020). Many birds have been seen with balloon strings hanging from their beaks or wrapped around their necks due to strong winds, which frequently cause balloons to drift toward the ocean (Abbing, 2019). Municipal, agricultural, and industrial wastes are said to be the main causes of water contamination worldwide, according to research from the University of Michigan (Richard et al., 2021). Leaks of pesticides and heavy metals into rivers, lakes, and streams, can sicken and kill birds, posing a hazard to certain species. Pollutants in water can also lower the oxygen content of the water, harming aquatic lives (Schweitzer & Noblet, 2018). Birds that depend on fish as a food source frequently need to migrate to other locations to find food, upsetting the natural equilibrium. The quantity of food available to migratory shorebirds has drastically decreased because of the pollution caused by inorganic nitrogen, phosphorus, oil, and heavy metals. Birds suffer

significantly from the contaminants in freshwater, mud, and invertebrates (Burger, 2002).

### ***Oil Pollution***

Oil pollution has a significant negative impact on "water birds," Approximately 500,000 aquatic birds die every year due to oil spills (Clark & Finley 1997). Even, shorebirds and seabirds are highly sensitive such pollution. When birds inhale or ingest PAHs (Write the expansion of PAH) and other oily substances, their feathers lose their capacity to protect them from the elements, which can lead to hypothermia and drowning (Tran et al., 2019). Oil gets coated in the feathers of the birds when they meet oil spilled water bodies which make feathers unable to act as a waterproof barrier (Delhey, 2007). As a result, a portion of their skin is uncovered and exposed to the elements. Birds commonly ingest the oil while trying to clean their feathers, which makes them sick or even kills them from poisoning.

### ***Anthropogenic Air Pollutants***

Most anthropogenic air pollution is caused by the burning of several kinds of fuels. The ecosystem and human health are both negatively impacted by the presence of pollutants in the air (King et al., 2021). Metal

concentrations in marine environments can go above background levels due to anthropogenic factors like domestic and industrial waste water effluents, urban and agricultural runoff, the combustion of fossil fuels, atmospheric deposition, and anti fouling paints from ships (Ma et al., 2022). The amount of food accessible to migratory shorebirds has drastically decreased as a result of the pollution caused by inorganic nitrogen, phosphorus, oil, and heavy metals. Birds suffer significantly from contaminants in the area's water, mud, and creatures (Richard et al., 2021). Numerous variables, including population density and diversity, reproduction, physical condition (feathers, weight, asymmetry, deformity), physiology, immunity, and genetics were used to evaluate the effects of air pollution on bioaccumulation and bio monitoring (Richard et al., 2021). Birds are commonly used to bio-monitor air pollution, help analyzing geographical distribution of pollutants such heavy metals, and follow their migration routes (mercury and lead mainly). The pollutants include polycyclic aromatic hydrocarbons (PAH), brominated diphenyl ethers, benzene, toluene, PCBs (expand), Sulphur dioxide,

and Nitrogen dioxide (Hao et al., 2021).

### ***Heavy Metal Pollution***

Studies have shown that heavy metals can also have an influence on the reproduction and general health of some birds. Birds' health has been proven to be negatively impacted by contaminants including cadmium, mercury, and selenium by lowering their growth or body weight (Wei Zhang et al., 2011). One of the most prevalent toxic illnesses that affect companion avian species is heavy metal toxicosis. It was also explored whether there was a link between heavy metals and parasites or sickness. Pesticides were also monitored for environmental pollution in some research, and in one study both pesticides and pharmaceuticals were monitored (Richard et al., 2021). Clearing any consumable heavy metals from the bird's habitat would avoid heavy metal poisoning (i.e., the cage and fencing materials). Using fencing and cages made of non-toxic materials including stainless steel and welded wires (Gall et al., 2015).

### ***Pesticides Pollution***

In addition to having an impact on birds, food chain, and environment, pesticides can have

both direct and indirect effects on insect populations as well. Using birds as biomarkers, environmental exposure to pollutants was assessed (Chen et al., 2009). Food webs and diets were used to explore the bioaccumulation and pathways of certain pollutants. DDT tends to accumulate because living things cannot break it down. When DDT is present in a bird's body, the eggshells shrink, killing the chicks before they hatch. This explains why DDT-related bird population declines are occurring (Hellou et al., 2013). DDT and other chemicals disrupted raptors' reproductive cycles. As the falcons consumed birds that had previously consumed insects and plants tainted with the chemicals, the poison accumulated in their bodies (Tesfahunegny, 2016). As a result, there was decreased fertility and eggs with fragile shells that cracked under the weight of the parents. Oil and related chemicals can harm birds' internal organs and alter their metabolism if consumed. This can result in issues like liver damage and hormone disruption, as well as dehydration and poisoning (Mora, 1997).

### ***Noise Pollution***

According to research, noise pollution has an impact on all of the birds' behavior, fitness, reproduction, growth, and frequently causes chronic stress. Persistent noise may create an acoustic blanket that muffles the aural cues which birds need to identify predators, rival species, and their own species (Francis et al., 2011). The stress of being startled by noise causes the birds to flee, wasting energy that could have been used for resting, finding food, or other essential tasks like mating. Three years of research by the University of Colorado has demonstrated how noise pollution impacts birds and their behavior. The ability of birds to communicate is the main issue they have when there is excessive noise.

Low-frequency vocalizations of birds are readily drowned out by noise pollution, which hinders their ability to mingle with other birds in their colony and seek a mate (Ortega, 2012). However, finches and other birds that vocalize at a higher frequency do not seem to be affected by the noise pollution's activity, seemingly oblivious to the mass

exodus of their other avian pals (Klingbeil et al., 2020).

### ***Light Pollution***

From the perspective of birds, there cannot be too much light. From a distance, illuminated cityscapes appear stunning at nights, but it doesn't help the lost bird find its way home. When city lights obscure the bright stars in the sky that birds use to plan their next day's travel, the birds might become disoriented and lost. Light pollution can change birds' flight patterns and make it challenging to follow their regular migratory paths. City birds struggle to fall asleep because of all the bright lights, and some birds have developed night-time behaviors (Klingbeil et al., 2020). Unfortunately, light pollution also leads to fatal accidents between some birds and nearby structures and other things in the sky that they may find challenging to notice while "blinded by the light."

## CONCLUSION

The effect of pollution and contaminants on avian populations has been highlighted in this chapter. The prevalence and environmental emissions of pharmaceutical wastes, heavy metals, pesticides, air pollutants, plastics, and oil are discussed in this chapter. The extinction of bird species has the potential to have a considerable influence on the health of ecosystem functioning and the ecological services that birds offer. The loss of habitat, urbanization, and pollution from human activity are exposing birds to an increasing number of contaminants and poisons. It is stressed that while if each of these pollutants has a large effect on its own, their interactions and the stress brought on by exposure to several pollutants may and do affect the health of bird populations. Their impact might range from immediate mortality to long-term changes in quality of life or reproductive potential, which have an impact on the population of the birds. The tiniest particles, for instance, may be able to flow through cell membranes or tissue barriers because large plastics can entangle but are continually broken down into smaller plastic sizes. Even though there are gaps in scientific understanding in al-

most every field, there is generally enough reliable evidence to warrant applying the precautionary principle and moving forward to swiftly protect birds and wildlife in general. Pollution and land-use changes are likely to exacerbate biodiversity threats in the future unless major reforms in political and economic policies are implemented. As a result, it is critical to reduce the usage of these contaminants and create other technologies that have a lesser impact on biodiversity. In order to safeguard birds and the ecosystem services they provide, alternatives to lessen human effect on nature should be developed and given highest concern. The cost of implementing mitigation plan is likely to vary extremely for each pollutant and may be significant. It may be perceived to be disproportionate from an economic standpoint in some circumstances, and thus, can become a causative reason to prevent mitigation policies from being implemented. Biodiversity conservation should be prioritized in order to sustain ecosystem services and environmental health. Multiple stressors must be considered for effective mitigation techniques. A lack of policy action should no longer be defended on the grounds of a lack

of understanding. And an, extensive research is required to plan and implement conservation and

management measures, particularly in the habitat areas of endangered or keystone species.

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