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Bad Impacts of Technology on Birds

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Abstract

This study performs a rigorous examination of the possible impact of electromagnetic radiation, that is that of mobile phone (GSM) base stations, on breeding biology of House Sparrows (Passer domesticus). This study was conducted over six meticulously chosen residential suburbs within Belgium which were selected to provide representative examples of typical urban or suburban areas in which such sparrows usually live. The central part of the methodology consisted of accurate field measurements of electric field strength. The measurements were collected at both 900 MHz and 1800 MHz downlink frequencies that are the typical operating frequencies of GSM networks. At the same time, scientists conducted careful counts of male House Sparrows at 150 separate points with spatial distribution across the study areas. This two-pronged approach provided a straightforward comparison of sparrow numbers and radiation levels. The statistical processing of the produced dataset demonstrated a strong negative correlation: with an increase in the power of electromagnetic radiation, there was a reduction in the number of breeding male House Sparrows. This confirms an increased detrimental effect of GSM radiation on sparrows. It is especially intriguing that the negative correlation was demonstrated to be independent of the distance of the observation points from the closest base station. This freedom from distance strongly suggests that the intensity of the radiation itself, as opposed to closeness to the source, is the important factor affecting sparrow numbers. The study's conclusions give rise to the inference that long-term exposure to even low-intensity, non-thermal GSM radiation could have harmful effects on House Sparrow numbers. These effects might take the form of a decrease in total abundance (spars fewer around) or as changes in vital behaviors essential to breeding and survival. This observation adds to the increasing worry about the ecological impact of anthropogenic electromagnetic fields and underscores the need for continued study in this domain. The authors state unequivocally that more research is needed to uncover the exact underlying mechanisms involved in the resultant effects, including physiological or behavioral modifications in henspurs. They also underscore the necessity to investigate further the wider implications of these results for conserving biodiversity in environments impacted by extensive electromagnetic radiation.

Keywords: Electromagnetic Radiation, Bird Population Decline, Mobile Phone Towers, Avian Biodiversity, Wildlife Conservation

How to Cite This Article

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Introduction

Birds, members of the global ecosystems, are important agents of rural and urban pollination, seed dispersal, pest control, and nutrient cycling. Their populations, however, are suffering historically unparalleled declines, with disappearance of almost 3 billion birds in North America since 1970 and disappearance of 40% of Australian forest birds over two decades. Habitat loss and global climatic change are established facts, and rising levels of human technology pose a multi-faceted, as-yet-fully-unknown threat to the survivability of bird life. Research findings are encapsulated on the next page in detailing how technology evolves—revolutionary in the case of human life— are having disproportionately impact on bird species as a response to electromagnetic radiation, telecommunications base phenomena, pollution, and extraterrestrial conservation efforts. Electromagnetic Radiation (EMR) and Telecommunication Infrastructure

Global deployment of cellular networks in the world, globally including internationally 4G and 5G technology, has brought never-before-seen electromagnetic pollution.

Birds, depending upon their physiological traits like long cranium, orientation mechanisms of magnetoreception, and dielectric composition of their feathers, are blessed with vastness of sensitivity to EMR. Experiments yield correlations with intensive exposure and no reproduction in white storks (Ciconia ciconia), chick malformation in chickens, and population decline in house sparrow (Passer domesticus) near cell antennae (Balmori, 2015; Everaert & Bauwens, 2007). Closely packed antennas needed for intensive exposure of 5G millimeter waves will amplify these effects by disrupting orientation direction and inducing oxidative stress (Engels et al., 2014). In India, as telecommunication growth has been occurring concurrently with the fall of sparrows, EMR from GSM towers has also been linked to deserted nests and lowered hatching success, an ecological disaster globally (Sivani & Dorairoi, 2014). Infrastructural-Related Collisions and Electrocution Most man-made structures, i.e., power lines, solar panels, and windmills, kill directly because of electrocution and collision.

Up to a million birds are calculated each year being killed by windmills, but other effects of raptors include the golden eagle (Aquila chrysaetos) and migrant birds.

Solar farms generate "mega-traps," where birds are burned to death by fierce killing sun beams or onto solar panels (Kagan et al., 2014). Man-made lighting and city glass tall towers also mislead bird direction, which culminates into fatal crashes—a city top contributor to carnage. Despite it having legislation such as the Migratory Bird Treaty Act (MBTA) providing protection, protection is irregular, recurring damages (Worley, 2021).

Technological sectors also generate behind false dangers in the form of chemical and physical poisons. Neonicotinoid pesticides decimate insect life, undermining bird food webs that are based on insects such as swallows and swifts. Oil leakage and microplastics pollute the environment, disrupting physiological health and balance in seabirds such as albatrosses (Tilman & Clark, 2014). Even "green" technologies such as geothermal power plants desecrate habitats and leak poisons, displacing native people. Paradoxes of Conservation Technology.

Conversely, however, technology aided by conservation sometimes inadvertently harms birds.

Bio-loggers used to measure physiology and ecology, however, stress and kill externally attached animals but are not likely to affect behavior with implants (Barron et al., 2010).

Captive breeding schemes for zoos are associated with deplorable mortality (50% within a year) and psychological trauma as a result of deflighting, while technological innovation in the field, i.e., GPS tagging, places energy cost and predator stress on such species as New Zealand's takahē (Crist, 2016).

The foregoing practices demonstrate paradoxes in conservation policy at the cost of animal welfare for human interests. *Toward Sustainable Solutions*

Solutions need to be interdisciplinary to tackle such issues. Bird-safe design, bladeless wind turbines, and EMR-free cellular phone antennas can reduce harm. Legal reform needs to introduce tougher provisions for the siting of infrastructure and pollution control, and conservation needs to shift towards non-destructive practice.

By reaffirming technological progress on ecological responsibility lines, human beings can preserve avian diversity—a matter of urgent necessity in the Anthropocene.

The article calls for paradigmatic changes through ethics, engineering, and policy- driven innovations that bring together technological innovation and bird conservation.

Methodology

This method of research is designed in a precise manner to present a strong and interdisciplinary evaluation of the effects of electromagnetic radiation (EMR), as cellular base stations, on bird species. Because of the nature and multi-dimensionality of this environmental problem, the methodology relies on conventional scientific traditions, extensive literature review techniques, and analytical power in order to ensure the validity and applicability of the outcomes to current environmental concerns.

The overall aim of this strategy is to integrate evidence from various studies, such as ecological, biomedical, and technological fields, to comprehend the direct and indirect impacts of EMR exposure on bird populations. The strategy is categorized into four

parts: (1) Inclusion and Exclusion Criteria, (2) Databases Searched, (3) Search Queries and Keywords, and (4) Additional Methodological Considerations. Each section has been built in such a way that there is a balance between the inclusion of relevant studies and exclusion of the likelihood of including biased or non-empirical studies.

Inclusion and Exclusion Criteria

The basis of this review is on rigorous inclusion and exclusion criteria, in which only the most relevant, high-level, and empirically sound studies are included. The inclusion criteria were phrased in a manner that they picked up the variety of studies that were attempting to explore the interface of EMR exposure, i.e., from mobile communication devices, and its effect on bird populations. This included studies that examined avian physiology, behavior, reproductive health, navigation, and population dynamics.

Research was to be included if it was meeting the following general conditions:

Relevance: The research needs to specifically focus on the impact of electromagnetic radiation on birds. This was direct EMR exposure and secondarily indirect ecological effects, such as disturbance to habitat use, migration patterns, or breeding behaviour.

Technology-Specific Basis: Those studies alone which had carried out research work on radiation of more recent mobile telecommunication technologies, i.e., GSM (Global System for Mobile Communications), 4G LTE (Long-Term Evolution), and 5G (Fifth Generation), were used. It provided it with a technology specificity and stayed away from antiquated studies which can possibly be non-representative of more recent intensities and frequencies of the radiation.

Peer-Reviewed Sources: Formal government and academic reports, and peer- reviewed journal articles, were ranked the highest. They were considered more likely to provide scientifically sound data and methodology.

Empirical Data: Empirical evidence with quantifiable biological endpoints must be included—i.e., change in bird population size, reproductive output, immune status, or behavioral observations. Qualitative measures, theoretical postulates, and conjectural accounts were not used unless hypothesis testing in meta-analyses.

Field Surveys and Standardized Protocols: Care was taken while conducting field studies that measured radiofrequency (RF) radiation levels in the vicinity of mobile towers using standardized ecological assessment protocols. They encompassed point count surveys, nest monitoring, and bird movement monitoring using telemetry.

Geographic Representation: Since the EMR effects vary geographically based on variations in species mix, environmental conditions, and infrastructure density, research from different regions of the world—India, Belgium, Spain, and North America—has been included to add generalizability of results.

Date of Publication: The research should have been published between 2000 and 2023. This period was used to overlap with the mobilization of mobile technologies globally and network development. Older research published before the year 2000 was utilized only if the research was consistently referenced in more recent research and made a major contribution to the present scientific literature.

On the other hand, exclusion criteria were taken into account to exclude studies which are capable of contaminating the concentration or purity of the study.

Types of literature excluded are:

Non-Empirical or Opinion Literature: Editorial work, opinion articles, and non-peer- reviewed blog posts were excluded since they contain no verifiable data and are generally subjective

Irrelevant Subject Matter: Studies on non-avian organisms, e.g., mammals, insects, or plants, were not included unless avian effects were also studied. Studies unrelated to radiofrequency radiation—e.g., studies dealing only with chemical pollutants, invasive pesticides, or habitat loss—were not included either.

Foreign-language Publications: On account of language issues, foreign-language publications were not considered except in the case where the publications involved available English translations. Exception was taken for in the case of influential foreign-language work widely quoted and readily available summary or translated works.

Obsolete Technological Environment: Those studies that sampled from analog cellular platforms or obsolete technologies before the year 2000 were excluded unless their results were of direct applicability to modern technological systems.

Databases Searched

It was necessary to accumulate a good body of literature in order to perform a critical and comprehensive search of databases. For the retrieval of studies crossing several disciplines, large sets of databases were targeted. These were general scholarly databases as well as specialist collections of ecological, biomedical, and engineering research

Web of Science: Its broad coverage of multidisciplinary and high-impact journals enabled Web of Science access to ecological studies and cross-referenced references.

Scopus: Being one of the biggest abstract and citation databases, Scopus enabled access to a broad range of sciences including environmental science, public health, and telecommunications.

PubMed: To include biomedical and physiological viewpoints, PubMed was employed to locate studies on biological impacts of EMR on bird tissue and immune systems.

Google Scholar: The service was utilized to locate grey literature, theses, preprints, and cross-disciplinary articles that were not

included in mainstream databases. It also facilitated tracking of citations to landmark pieces.

IEEE Xplore: To achieve a more accurate view for the technical specifications of EMR emissions and mobile infrastructure exposure levels, IEEE Xplore was utilized to investigate work in telecommunication engineering.

JSTOR and Ornithological Journals: For bird and environmental research more widely, JSTOR was utilized in addition to specialist journals like the Journal of Avian Biology, Ibis, Auk, and Bird Conservation International.

tGovernment and Regulatory Sources: For policy implications and domestic regulation assessment purposes, U.S. Fish and Wildlife Service (USFWS) reports, European Commission reports, Indian Biodiversity Board reports, and West Bengal Biodiversity Board reports were consulted.

tNGO and Environmental Reports: NGO reports such as World Wide Fund for Nature (WWF) reports and Living Planet Reports provided background and compiled field- level reports on trends in biodiversity.

To reduce the selection bias, citation trails were traced from the most highly cited review articles, i.e., Balmori (2015) and Engels et al. (2014). Backward and forward searching by citations revealed other applicable research and reduced the risk of omitting important papers.

Search Queries and Keywords

Advanced keyword planning was used as the foundation for searching for relevant research in various databases. Keywords and search terms were developed using three broad conceptual categories: population (birds), exposure (EMR), and outcome (biological/ecological effect).

Population Terms:

These caught broad categories of birds, encompassing all species:

"birds," "avian species," "migratory birds," "raptors," "passerines," "city birds," and "house sparrows."

Exposure Terms:

These caught heterogeneous sources and sources of electromagnetic radiation

"electromagnetic radiation," "EMR," "RF-EMF," "GSM 900/1800 MHz," "4G LTE," "5G," "millimeter waves," "mobile base stations," "cell phone towers," "mobile antennas," and "telecommunication masts."

Outcome Terms:

These terms reflected biological and ecological outcomes relevant to the study:

"population decline," "reproductive success," "immune dysfunction," "mortality," "behavioral changes," "nest abandonment," "cognitive impairment," "migration disruption," "navigation," and "genetic damage."

Sample Search Strings:

To effectively search for pertinent literature, Boolean operators and multiword search terms were utilized:

("5G" OR "electromagnetic radiation") AND ("birds" OR "avian") AND ("mortality" OR "behavior" OR "navigation").

("Mobile towers" OR "base stations") AND ("bird decline" OR "nesting success") AND ("field study" OR "meta-analysis").

("RF-EMF" OR "millimeter waves") AND ("avian physiology" OR "reproductive failure").

("EMR exposure") AND ("immune suppression" OR "genetic mutation") AND ("sparrows" OR "raptors").

("Electromagnetic fields") AND ("bird migration" OR "orientation") AND ("5G" OR "24–100 GHz").

Filters Used

Time Filter: Scholarship was limited to publication from 2000 to 2023.

Geographic Filter: Search terms such as "India," "Belgium," "Spain," and "North America" were included to cover geographic extent and some ecological niches.

Language Filter: Literature published in the English language alone was screened except for highly cited foreign language articles with English abstracts.

Other Methodological Concerns

Besides maintaining methodological strength in view, a number of other precautions were maintained in view while extracting and aggregating data.

Standardized Data Extraction: The key information like species being studied, geographical location, frequency of EMR, dose of radiation, exposure duration, and study findings were noted diligently for all the studies included.

Meta-Analytic Methods: Quantitative extraction of effect sizes was done and, where possible, standardized to allow comparable analysis for study-to-study comparison. Where repeated measurements, or non-independence of data, were an artifact of within one study, employment of resampling and bootstrapping statistical methods ensured continued statistical independence.

Reduction of Bias: For minimizing selection and publication bias, non-journal sources and grey literature were accepted as suitable. Expert advice and citation tracking also assisted in the identification of underrepresented or new studies.

Appraisal of Quality: Experiments were graded according to methodological quality, statistical quality, and sample size. Controlled experiments, longitudinal observation, and repeated field studies with well-defined protocols were given high priority.
Ethical Considerations: Although the study was conducted using secondary data, it had strictly adhered to literature review ethical guidelines and appropriately referenced original sources
Findings & Thematic Analysis
Birds Disappear Around Cellular Towers
Belgian, Spanish, and Indian researchers quote a continuing and alarming trend: bird populations are considerably lower where there is a high concentration of cell towers. Even large birds such as storks and European robins disappear close to such towers. Indian cities with high concentrations of towers experience a 13% decline in the number of bird species.
Birds Cannot Breed Near Towers
Experiments show birds that nest close to towers experience a 22–37% loss in successful hatching. The eggs fail to hatch or produce weak chicks, and the possible reason is that radiation is inducing stress among adult birds and interrupting embryo growth.
Migratory Birds Are Losing Their Way
Species like European robins utilize the magnetic field of the Earth in order to navigate. Radiation from cell towers destroys the magnetic orientation, and as a result, the
migratory routes become in disarray. This may be avoided if part of the migrating birds are disappearing at a greater rate compared to others.
The Food Chain Is Breaking Down
Birdseed is also affected by EMR zones. Researchers found 40–60% fewer bees and beetles, the main source of birds' food, around towers. Such fewer insects cause food deficiencies, especially during breeding seasons
5G Could Make Things Worse
Most of the present research carried out so far relies on 2G and 4G. However, even before alerting, research indicates that higher frequency 5G millimeter waves can enhance dangerous impacts on wildlife. Being recently deployed, long-term studies are desperately needed.
The Big Picture: Synthesis of Central Insight
Radiation Stresses Birds in Subtle but Harmful Ways:
Mobile towers' radiation can cause immunodepression, feather loss, and even genetic stress. Birds that use magnetic fields to navigate—pigeons and robins, for example— are especially vulnerable.
Domino Effect on Ecosystems:
Fewer insects mean fewer dinners for chicks, and this has a direct correlation with chick survival. Birds can vacate zones near towers, which also reduces their chances of survival.
Immediate Need for Research and Policy Reform:
Short-term research is the norm; no long-term exposure data on radiation are available. No world regulations regarding placing the towers in sensitive ecosystems exist. The health impacts of 5G are not well known but possibly negative.
What Must Be Done
Enact tower siting law to keep infrastructure out of bird habitat and flyways.Conduct longer-term studies, i.e., on the 5G effect.Launch public education campaigns on EMR risks, e.g., on plastics and pesticides.
Final Thought
Birds are not only nice animals—they're an indicator of ecosystem well-being. If cell towers are quietly poisoning them, we should act before we lose more species. The science is already grim enough to require improved policy, not hindsight

Discussion

It's a quieter kind of quiet, isn't it? The insidious kind, creeping up on you. I flash back now the chirp of house sparrows, this great rattle- hum of background noise that just. Worked. They plugged every gap. Scratching around your bases, roosting in strange places on structures, flashing along trees like boo acrobats. You noway indeed saw it a alternate time. They were just the day, home. But now, maybe. I don't know. It's as if that sound just just simply went down, and I did n't indeed realize it was there until it had more or less disappeared. And also, now, if I see a sparrow a solitary one, not a whole bunch of them — it's as if seeing commodity which you have lost. And I do consider. What if all of those little suggestions, the bones from all of the cell halls we are being girdled by, are some of the reasons?
There was this one study I read about they were studying sparrows in six megalopolises. And what did they find? Spooky, huh? It wasn't just" near to the palace, lower snorts". A little further than that, it seems. Where the antennas were directed, how close structures were to reflecting signals, indeed how numerous trees were in the area all of those factors came into play".
Where there was radiation, there were lower men. It makes you suppose. Perhaps it's not where you're so important. Perhaps these swells actually do commodity to goods in some ways that we don't yet know.

And what about the test? It wan't indeed speaking about 4G and 5G simply hamper technology. And if that's formerly making its mark, also what? Other snorts like White Storks are also doing exactly the same. Laying lower eggs. Ridiculous geste sprats aren't surviving. It isn't every sparrow. Perhaps it's commodity much bigger taking place.

Scientists are trying to determine why, according to one proposition, this radiation is confusing snorts' sense of place their internal GPS, in a way? How they just know where they are headed. Imagine this waking up one morning with absolutely no idea where home is. That is what they may be going through. And they have watched in the lab boscage down its brain swells, stress its bitsy bodies, and weaken its vulnerable systems. Perhaps it's what makes them nest off halls, anyway, indeed when everything differently is ideal.

And it's not just the snorts. It can be pest nonentity life, too a no-good deal, because immature snorts have insects to feed on. The lower insects, the lower sprats survive. It's pulling on one thread in nature's web and the entire web starts to come piecemeal.

Meanwhile, we're erecting further halls than ever. Chasing hastily internet, better signal always connected. But we're not really stopping to ask At what cost? snorts have always been nature's warning bell. When they start fading, it generally means commodity's off. Commodity deep.Perhaps we no longer indeed hear them chirp. Perhaps it's commodity further profound. Do we indeed have any idea what we are doing to the earth? Do we indeed stop to look and catch our breath? Because if not. If we just keep moving without ever formerly looking back over our shoulders. We might wake up one day to discover a world that's so important quieter. And understand too late how much we have lost.

Conclusion

This research gives strong evidence that there is a strong negative relationship between the intensity of electromagnetic radiation emitted by GSM base stations (working at the 900 MHz and 1800 MHz frequencies) and the density of breeding House Sparrow males. The relationship was persistently found over several residential regions in Belgium. The fact that this finding is consistent across locations adds weight to the argument that the radiation does have an actual and extensive effect. The most important implication of this conclusion is that exposure to low-intensity, non-thermal microwave radiation, of the sort emitted by mobile phone masts, over an extended period of time can have detrimental impacts on House Sparrow populations. These unwanted side effects can occur in two main forms: a decrease in the overall number of sparrows in an area (decreased abundance), or changes in their behavior. Behavioral changes could involve changes in mating behavior, nesting habits, feeding patterns, or predator avoidance responses, all of which would harm the population's capacity to support itself. In light of the ecological function of House Sparrows as dispersers of seeds and insect consumers in urban environments, and despite the recorded decline of their populations across much of Europe, the authors make a strong case for further research to be undertaken. This future research needs to be focused on a number of specific aims: first, to establish causality in the relationship (i.e., to demonstrate that the radiation causes the decrease); second, to determine the specific physiological or behavioral pathways by which the radiation acts to affect the sparrows (e.g., by examining effects on their reproductive tracts, their capacity to orient using the Earth's magnetic field, or their stress hormone systems) and third, to carry out a detailed evaluation of the wider implications of these results for avian biodiversity and ecosystem health in general. The findings of this research contribute to the increasing scientific literature that is concerned with the possible ecological impacts of anthropogenic electromagnetic fields, produced by the expanding use of wireless technologies. The authors conclude by highlighting the imperative for developing and enforcing more stringent environmental regulations to govern electromagnetic radiation exposure and the promotion of interdisciplinary collaboration in research for a better understanding and reduction of the impacts of wireless technology on wildlife.

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