

## Plastic Pollution and Its Effects on Avian Feeding Behavior: Educational Interventions in Indian Schools

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### ABSTRACT

Plastic pollution has spread throughout almost all ecosystems worldwide which results in birds becoming their primary visible victims. India produces about 3.5 million tonnes of plastic waste every year because this results in serious harm to its bird population which scientists continue to study. This article shows how plastic waste changes how birds search for food by using scientific studies and field research conducted in urban areas and coastal regions and wetland sites. The study explains how birds develop a habit of consuming plastic waste when they mistake it for food and thus they contaminate themselves with microplastics through their contaminated prey while they accidentally feed plastic waste to their chicks which results in negative impacts on their survival and growth and reproductive abilities. The article then shifts its focus to the Indian school system, asking how this ecological crisis can be transformed into a powerful curriculum opportunity. The study evaluates current environmental education systems which exist under India's National Education Policy 2020 while it recommends educational programs that need scientific proof to create ecological understanding among students through citizen science activities and field research and community-based educational activities. The goal aims to develop pure awareness because people need to connect with nature through scientific practices.

**Keywords:** avian feeding behavior, Indian schools, microplastics, plastic pollution, environmental education, wildlife conservation

### I. Introduction

The street birds called house sparrows consume grains which they find on the pavement. The crows search through trash piles to find their desired items. Kites fly above the fish markets while searching for food. The black-headed ibises stand in the water which flows through the drainage ditches. India is, by any measure, a country extraordinarily rich in bird life, it hosts over 1,300 species, according to the Bombay Natural History Society (BNHS, 2021). The existing bird population shows signs of distress because their eating patterns and food preferences have been disturbed.

Urban and peri-urban environments in India now contain plastic waste, which birds encounter during their natural activities. The 2019 Central Pollution Control Board report found that India produces approximately 3.5 million tonnes of plastic waste each year, while the country struggles to collect and dispose of this waste properly. The area now displays plastic waste which covers streets and rivers and wetlands and agricultural fields and coastal regions. For birds that search for food by sight at short distances, the environment presents them with actual confusion. The colorful plastic pieces take on the appearance of berries, seeds, and invertebrate food. The thin plastic film covers pieces of organic waste material. Waterbirds hunt aquatic

plants which have fishing line entangled within them.

The scientific literature on plastic ingestion in birds has grown substantially over the past two decades. The problem that used to affect seabirds on remote islands now spreads to different species which live on land and in freshwater and coastal environments throughout populated areas including India. The research identifies three methods through which people find food, birds use visual illusions, and they accidentally consume their natural food. The body experiences various effects, which include gut blockage and nutritional deficiency and chemical poisoning and decreased ability to reproduce.

The fact that Indian school curricula have not explored this matter more thoroughly surprises me. Environmental topics appear in textbooks but they tend toward the general and the abstract. Plastic pollution affecting local birds the crow outside the classroom window the pond heron in the school's neighboring wetland is exactly the kind of tangible observable emotionally resonant issue that good science education is built around. The article presents evidence-based proposals to support bringing it into the system.

## II. The Plastic Pollution Crisis in India: A Brief Overview

### 2.1 Scale and Sources

The main cause of India's plastic waste problem exists within its system. The country which has the second highest population worldwide faces challenges because its consumer market keeps expanding while its waste management system lacks capacity to handle current waste volumes. The Central Pollution Control Board (2019) estimated that India generates roughly 26,000 tonnes of plastic waste daily. Roughly 40% of that goes uncollected and ends up in open environments — streets, water bodies, agricultural land.

The primary waste material consists of single-use plastics which include packaging film sachets bottles straws disposable cutlery and polystyrene food containers. Many of these items are lightweight and aerodynamic which enables them to travel across long distances from disposal points until they eventually settle in habitats used by wildlife. India's rivers carry significant plastic loads to the coast. The Ganges River ranks as one of the top plastic-transporting rivers worldwide according to a study published in Nature Communications (Lebreton et al., 2017). Plastic waste from upstream sources continuously contaminates coastal and riparian bird habitats throughout the country while local sources also provide contamination.

### 2.2 Microplastics: The Invisible Problem

Microplastics represent a distinct environmental danger which exists beyond visible debris because they consist of particles that measure less than 5 millimeters in size. The substances develop through the process of photodegradation which breaks down plastic waste into smaller pieces that ultimately

end up in various natural environments such as water bodies and soil and sediment areas. The scientific literature shows that birds which eat aquatic invertebrates and small fish and soil organisms proceed to ingest microplastics through their dietary habits. The research which appeared in Environmental Science & Technology (Rochman et al., 2015) proved that fish living in polluted habitats develop body microplastic accumulation which becomes part of their diet when birds eat these fish through their natural hunting activities. The pathway which leads to indirect ingestion of substances presents students with greater difficulties for observation and understanding than the direct observation of a bird eating a plastic bag yet both pathways produce equal environmental impacts which become hidden dangers in their effect on wildlife.

## III. How Plastic Alters Avian Feeding Behavior

### 3.1 Visual Misidentification and Direct Ingestion

Birds use their eyesight to search for food because they depend on visual information during their hunting activities. Shape, color, size, and contrast all factor into food selection decisions that happen in fractions of a second. Plastic debris exploits these fast, automatic processes. People confuse red and orange plastic pieces with berries and invertebrates. White polystyrene pellets resemble fish eggs. Thin transparent film can look like the surface shimmer of water or the wings of small insects.

Seabird research has provided the most extensive documentation of this phenomenon. A landmark study by van Franeker and Law (2015) in Environmental Pollution found that 90% of Northern Fulmars sampled in the North Sea had plastic in their stomachs. The same patterns that exist for Northern Fulmars which are oceanic birds now appear among South Asian coastal birds and inland birds. Research on Indian species, though still developing, has found plastic in the stomachs of house crows, rock pigeons, and various shorebird species in coastal Gujarat and Maharashtra.

The color preference dimension needs to receive thorough examination because it shows important features. Experiments with both captive and free-ranging birds demonstrate that certain species acquire fixed color preferences for specific plastic colors which match their preferred natural food items. Ryan et al. (2016), writing in Marine Pollution Bulletin, documented color-selective plastic ingestion in seabirds, suggesting this is not random accident but a systematic behavioral mismatch.

### 3.2 Parental Feeding and Chick Mortality

Plastic waste which birds consume results in their most disastrous effect when adult birds feed plastic to their chicks. The parents who have consumed plastic will throw it up to their chicks which they feed either on purpose or by accident. Parents feed their chicks through direct regurgitation yet the chicks lack the ability to differentiate between plastic and their natural food items. The Laysan Albatross on Midway Atoll has become the iconic image of this problem globally, with photographs of chick carcasses containing hundreds of plastic fragments circulating widely since the early 2010s. Indian coastal and wetland birds face the same environmental challenges which threaten their survival. Shorebird species nesting along the Gujarat and Tamil Nadu coasts forage in environments where plastic debris overlaps significantly with natural prey items. The peer-

reviewed literature lacks sufficient documentation about chick mortality which results from plastic ingestion in Indian bird species while this fact serves as a curriculum-related point because it shows students which scientific research areas need study and fieldwork provides essential information.

### 3.3 Behavioral Displacement and Habitat Avoidance

The impact of plastic pollution extends beyond its ingestion by birds. The recognition of behavioral displacement as a secondary effect has been growing throughout time. The presence of plastic debris in dense concentrations creates physical changes to foraging areas, which occurs when floating plastic mats on wetlands block wading birds from reaching open water. Birds will not use feeding areas that contain high contamination levels because their prior experiences

show this area does not provide successful foraging, which results in reduced space for them to hunt.

The study conducted in India urban wetlands examined waterbird foraging patterns which researchers published in Wetlands Ecology and Management (Urfi, 2011) showed how disturbance and habitat degradation through waste accumulation that occurred at the Okhla Bird Sanctuary in Delhi affected foraging site selection by painted storks and other colonial waterbirds. The study established the behavioral sensitivity of Indian waterbirds to environmental degradation in their feeding habitats even though it predates research on plastic waste.

As shown in Figure 1, plastic ingestion in birds follows a multi-pathway model that connects environmental plastic loads to fitness consequences through a chain of behavioral and physiological steps.

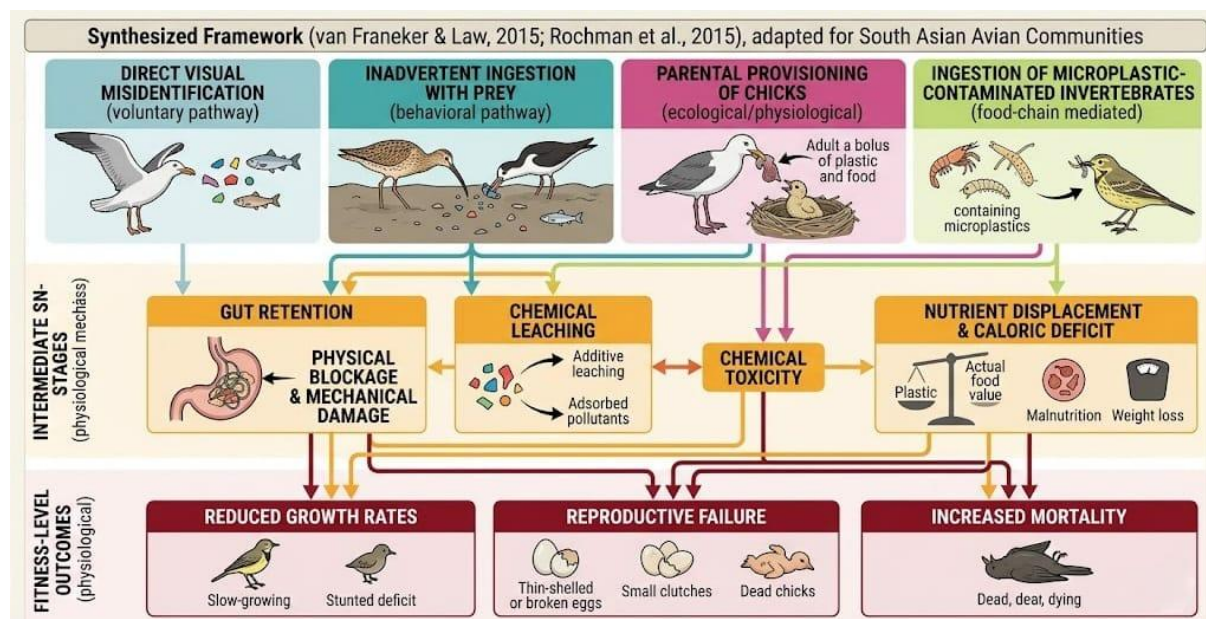


Figure 1: Pathways of Plastic Exposure and Fitness Consequences in Avian Species

The flowchart shows four main ways that people can see plastic waste, which includes direct visual misidentification of plastic as actual food, which leads to people accidentally eating plastic waste along with their food, while chicks receive food from their parents and birds consume invertebrates that have been contaminated with microplastic. The pathways use different colors to help people understand the three types of mechanisms which include voluntary behavior, food-chain mediated ecological processes, and internal physiological functions. The diagram synthesizes frameworks from van Franeker & Law (2015) in Environmental Pollution and Rochman et

al. (2015) in Environmental Science & Technology, and is adapted for application to South Asian avian communities.

## IV. Documented Cases and Emerging Evidence from India

### 4.1 Urban Scavengers

Crows and kites constitute the most common urban bird species in India, which results in their high exposure to plastic pollution because they search for food in waste materials. House crows (*Corvus splendens*) and black kites (*Milvus migrans*) frequently search through public waste dumps which contain numerous plastic-encased

food remains. The research conducted in Delhi, Mumbai, and Kolkata revealed both bird species at dump sites consume plastic film together with their regular waste disposal items.

Researchers have investigated black kites because of their exceptional capacity to utilize food sources present in urban environments. Shultz et al. (2019) published their research work in PLOS ONE which studied kite foraging behavior in Delhi through its observation of their feeding activities at garbage disposal sites. The study focused on disease ecology, but it showed the complete range of human waste materials that this species interacts with, which includes plastic materials that the bird encounters during each feeding session.

#### **4.2 Waterbirds and Coastal Species**

India has a coastline that extends beyond 7500 kilometers which creates a habitat for numerous waterbird species. Egrets herons terns skimmers and waders all depend on shallow coastal and estuarine habitats that are among the most plastic-contaminated environments in the country because those areas receive plastic waste from all nearby coastal towns and their location at the downstream end of river systems.

The research about Indian waterbirds who ingest plastic materials remains limited when we compare it to existing seabird studies which cover other parts of the world but researchers have found disturbing information. Jayasena et al. (2011) conducted research in Sri Lanka which is an ecologically similar area to southern India and found plastic waste inside the digestive systems of various heron species. The students should learn this information about scientific research: scientists can draw reasonable scientific conclusions between two places when researchers have not collected enough specific data about both locations.

### **V. Environmental Education in Indian Schools: Current State**

#### **5.1 What the Curriculum Currently Offers**

The school curriculum in India uses multiple methods to teach students about environmental problems. The National Council of Educational Research and Training (NCERT) establishes environmental studies as a required subject for all students who study at upper primary level while secondary students learn ecology and conservation through their science textbooks. The Central Board of Secondary Education (CBSE) added environmental education requirements to its programs because of Supreme Court orders which originated in the 1990s.

The National Education Policy 2020 (NEP 2020) which the Ministry of Education published, requires schools to teach students through experiential learning techniques while developing their critical thinking abilities and using local knowledge in their teaching methods. The educational framework requires schools to create learning experiences which connect students to their immediate surroundings and their home communities and their natural environments and their personal life experiences. The framework offers an ideal system which uses environmental education to teach students about local biodiversity and local pollution problems.

The gap between policy intent and classroom reality, however, remains wide. A review of NCERT science textbooks at the secondary level shows that environmental content tends toward descriptive rather than investigative approaches. Students learn about food chains and ecosystem services but they do not practice data collection outside their studies nor handle actual local ecological research. Students learn about plastic pollution yet they only study it as a general problem which they cannot study through direct observation and measurement and analysis.

#### **5.2 What Is Missing**

The most important thing missing from current environmental education in Indian schools is granularity and agency. Students need to engage with specific, local, observable phenomena, not abstract global statistics. Students need to create their own questions and design simple investigations and analyze actual data. The interaction between plastic pollution and local bird feeding behavior offers all of this. Every Indian school exists in proximity to bird life because all schools exist in either urban or rural areas. Schools in the Indo-Gangetic Plain are situated close to wetlands and agricultural lands which attract hundreds of bird species. Coastal schools have immediate access to beaches where plastic debris and foraging waterbirds coexist. Urban schools provide students with daily opportunities to observe roof-nesting pigeons and tree sparrows and resident crows. The ecological story exists right outside the classroom door.

### **VI. Proposed Educational Interventions**

#### **6.1 Structured Field Observation Programs**

The simplest form of direct intervention requires teachers to bring students to outdoor locations where they can observe birds. Students develop their observational abilities while acquiring fundamental ecological knowledge through structured birdwatching activities that employ standardized observation sheets for recording

species and their respective behaviors and foraging locations and their interactions with waste and debris. Indian organizations support birdwatching activities that take place in schools across the country. The BNHS operates educational programs while creating teaching materials for instructor development. The eBird India platform enables students to submit bird count information which supports national monitoring databases through its collaboration with the Cornell Lab of Ornithology. Students who engage in structured citizen science programs acquire real scientific skills which extend beyond typical classroom work. The data they collect serves a critical purpose because it directly impacts their research efforts.

### 6.2 Citizen Science and Plastic Monitoring

The educational value of bird observation studies becomes more powerful when combined with plastic debris surveys. Students conduct plastic distribution mapping through their studies of local park areas and school grounds and adjacent water

bodies while they investigate whether different bird species behavior and foraging patterns and visible attempts to consume plastic and their presence in the area. Secondary school students can understand this fundamental ecological reasoning because its requirements for understanding are not demanding.

The Tangaroa Blue Foundation's debris monitoring methodology, which Indian coastal conservation organizations have adopted and implemented, establishes a standardized plastic survey method that students can use for their research. Students learn to connect their local survey results with national statistics by using CPCB plastic waste generation data which shows how local patterns relate to broader environmental trends.

As shown in Figure 2, a well-structured school-based intervention program builds from foundational ecological knowledge through field skills to genuine scientific inquiry, producing both ecological literacy and personal connection to local wildlife.

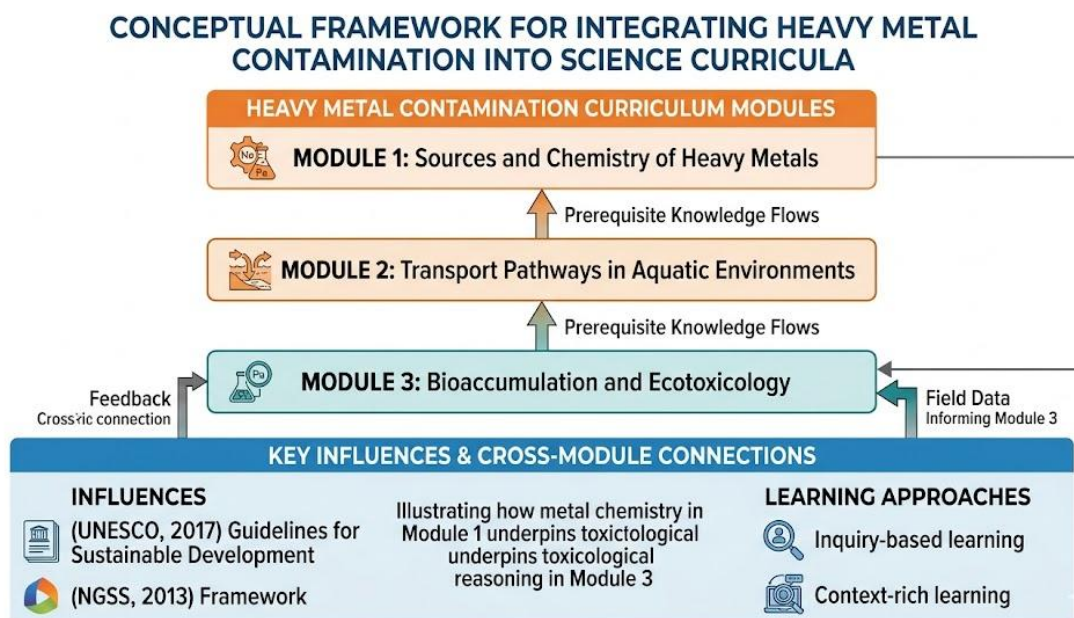


Figure 2: Tiered Educational Intervention Framework for Plastic Pollution and Avian Ecology in Indian Secondary Schools

The diagram shows three learning levels which develop three educational stages: The first level shows students learning about different types of plastics and environmental pathways and Indian bird species in classroom teaching. The second level of learning introduces students to structured birdwatching and behavior ethograms and plastic debris mapping techniques. The third level of learning requires students to conduct hypothesis research and participate in citizen science projects

and community outreach activities. The upward arrows show how knowledge and skills move between different tiers of learning while the feedback arrows demonstrate how field data and community reactions guide upcoming research activities. The framework uses UNESCO's Education for Sustainable Development learning principles which UNESCO established in 2017 to support its competency-based educational system which India National Education Policy 2020

recommends (Ministry of Education, Government of India, 2020).

### 6.3 Community-Linked and Cross-Curricular Projects

Environmental education works best when it extends beyond the science classroom. Students can conduct cross-disciplinary research through plastic pollution and bird studies which require them to write field journals and scientific reports for language arts and study waste management policy and municipal infrastructure for social studies and compute plastic loads and population trends for mathematics and create documentary illustrations and communication designs for visual arts. Community-linked projects add another dimension. The students who interview local fishermen about waterbird population changes at fishing sites and who survey market vendors about their plastic packaging methods study ecological issues through a social and economic framework. This kind of place-based learning represents the integrated educational model which NEP 2020 aims to establish while environmental education research shows this method produces better results than teaching methods which focus on single subjects within classroom space (Stevenson et al., 2013).

### 6.4 Teacher Training and Resource Development

Teachers require proper support for all teaching methods to succeed in their work. Environmental science in Indian schools is taught by teachers who have physics and chemistry and biology training as their main field of expertise but who still need more experience in field ecology and conservation science. Teacher training programs need to deliver subject content together with teaching methods that support outdoor learning activities.

WWF-India and BNHS and the Wildlife Institute of India (WII) have created teacher training materials and state governments have organized workshops to teach environmental education. The educational delivery of environmental content will improve through the implementation of environmentally friendly educational programs which should include plastic-wildlife interaction studies as a core subject.

## VI. Conclusion

Birds in India face challenges with food finding and food selection and food consumption because of plastic pollution which affects all Indian ecosystems. The mechanisms are well enough understood visual misidentification and food-chain contamination and parental provisioning errors that they can be taught clearly and compellingly to

school students. The evidence base, while still developing for specifically Indian species, is sufficient to ground serious curriculum content.

Indian schools, supported by the NEP 2020's push toward experiential and context-based learning, have both the mandate and the opportunity to engage students with this issue at a level of depth and specificity that moves beyond awareness campaigns. All of these elements, including structured field observation and citizen science participation and cross-curricular projects and community-connected inquiry, will create this outcome. The curriculum development work needs to create classroom-ready programs for ecological science which should receive teacher training and organizational partnerships.

Birds serve as primary indicators for both environmental health assessment and assessment of their emotional value and their ecological significance. All Indian schools have birds that live nearby. Every school also has plastic. The classroom connection between those two facts is waiting to be made, systematically, scientifically, and with the kind of engaged curiosity that good education produces.

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