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Environmental Knowledge, Conservation Attitudes, and Public Perceptions of Human Impacts on Bird Populations: A Survey Study

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Abstract. Bird population decline is a serious issue under anthropogenic influences of the natural world, making public understanding and knowledge of these issues integral for conservation in the future. The study examined public knowledge of avian ecology alongside anthropogenic threats in key categories among knowledge, attitude, engagement and environmental exposure. The study used a survey consulting 45 participants globally in an assessment of the aforementioned categories. Participants demonstrated strong grasps of basic ecological concepts, but showed variance in questions regarding climate change, light pollution, and noise pollution. Environmental knowledge differed demographically in country, living environment, age, and education, with formal education providing the highest increase in environmental knowledge scores. The findings of this study go to suggest that environmental education approaches should combine factual knowledge with approaches fostering direct exposure to the environment.

Keywords: Avian Ecology, Anthropogenic Threats, Engagement, Environmental Exposure

1. Introduction

Bird populations have declined substantially in recent decades, largely because of human activities such as habitat loss, urbanization, pollution, and other anthropogenic disturbances [1, 2]. These pressures threaten not only bird diversity but also the ecosystem services birds provide, including seed dispersal, pollination, pest control, and nutrient cycling [3]. Although conservation measures have successfully reduced some threats, such as the impacts of DDT, emerging environmental challenges—including artificial light, noise pollution, and climate change—continue to affect bird populations [4, 5]. Effective conservation depends not only on scientific research and environmental policy but also on public understanding of ecological issues. Individuals with greater environmental knowledge may be more likely to support conservation initiatives and adopt environmentally responsible behaviors [6]. However, knowledge alone may not necessarily translate into positive conservation attitudes or environmental engagement, and demographic characteristics, educational experiences, and environmental exposure may also influence environmental literacy. Therefore, this study used a survey-based approach to examine public understanding of bird ecology and human impacts on bird populations. Specifically, the study aimed to (1) assess environmental knowledge of

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bird ecology and major threats, (2) examine differences across demographic characteristics and information sources, (3) investigate relationships among environmental knowledge, conservation attitudes, and environmental engagement, and (4) evaluate whether environmental exposure was associated with greater environmental knowledge.

2. Methods

2.1. Participants

A total of 45 participants completed an anonymous online survey examining environmental knowledge, conservation attitudes, environmental engagement, and sources of environmental information. Participants represented diverse demographic backgrounds in terms of country of residence, living environment, age, and educational level. Participation was voluntary, informed consent was obtained from all participants, and no personally identifiable information was collected.

2.2. Survey design

The questionnaire consisted of four sections. The first collected demographic information, including country of residence, living environment, age group, and highest level of education. The second assessed environmental knowledge using 13 multiple-choice and multiple-response questions covering bird ecology, biodiversity, habitat loss, pollution, urbanization, and ecosystem services. Correct responses were scored to generate an overall environmental knowledge score ranging from 0 to 1, with partial credit awarded for multiple-response questions. The third section measured conservation attitudes using five Likert-scale statements (1 = Strongly disagree to 5 = Strongly agree). The fourth assessed environmental engagement using six Likert-scale items evaluating environmentally responsible behaviors. Following internal consistency analysis, one item was excluded to improve reliability, and the remaining items were averaged to generate the final engagement score. Participants also reported their primary sources of environmental information (school or formal education, social media, news media, documentaries, and friends or family), as well as their interest in nature, frequency of exposure to environmental topics, and time spent in natural environments.

2.3. Statistical analysis

All analyses were conducted in Python. Descriptive statistics summarized participant characteristics and response distributions, and accuracy rates were calculated for each environmental knowledge question. Because knowledge scores were not normally distributed, non-parametric tests were used throughout. Mann–Whitney U tests compared two-group differences (country, living environment, and information sources), while Kruskal–Wallis H tests compared multiple groups (age and education). Associations among environmental knowledge, conservation attitudes, environmental engagement, and environmental exposure variables were assessed using Spearman's rank correlation coefficient (ρ). Statistical significance was defined as $p < .05$. Results were visualized using bar charts, boxplots, and correlation plots.

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3. Results

3.1. Participant characteristics

A total of 45 participants completed the survey and were included in the analysis. Participants represented diverse demographic backgrounds, including different countries of residence, living environments, age groups, and educational levels. Twenty-eight participants (62.2%) resided in China and fifteen (33.3%) in the United States, while the remaining participants were from other countries and were not included in country-based comparisons due to the small sample size. Most participants lived in urban areas (n = 30), whereas 14 lived in suburban environments. Participants also represented a range of educational backgrounds, including high school students (n = 15), undergraduate students (n = 15), and graduate-level or above participants (n = 14). These demographic variables were subsequently examined for their associations with environmental knowledge.

3.2. Environmental knowledge across individual knowledge items

Participants generally demonstrated a high level of environmental knowledge, although accuracy varied across individual questions (Figure 1A). The highest accuracy was observed for ecosystem balance (97.8%) and pesticide impacts on birds (95.6%). In contrast, participants showed lower accuracy for questions related to anthropogenic noise (55.6%), artificial light pollution (53.3%), and the misconception that all bird species control insect populations (24.4%), indicating important knowledge gaps regarding human impacts on bird ecology.

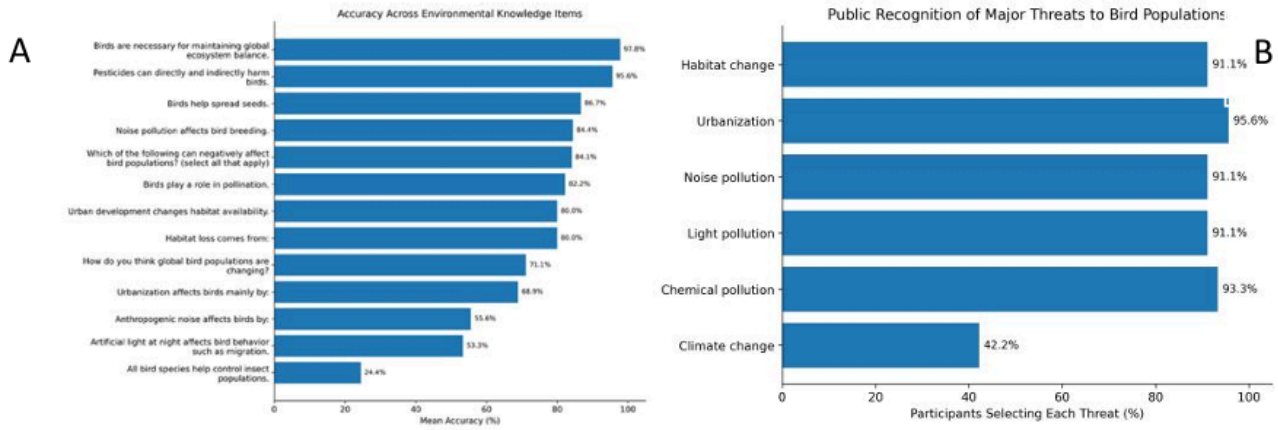

Figure 1. Environmental knowledge and perceived threats to bird populations

(A) Accuracy across individual environmental knowledge items. (B) Percentage of participants identifying each environmental factor as a threat to bird populations.

3.3. Public recognition of major threats to bird populations

Participants showed strong awareness of several major anthropogenic threats to birds (Figure 1B). Urbanization was the most frequently identified threat (95.6%), followed by chemical pollution (93.3%). Habitat change, noise pollution, and light pollution were each recognized by 91.1% of participants. In contrast, climate change was identified by only 42.2% of respondents, making it the least frequently recognized threat despite its well-established ecological importance. This finding

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suggests that while participants readily associate local human activities with bird declines, the role of global climate change may be comparatively underrecognized.

3.4. Demographic and information-source differences in environmental knowledge

Environmental knowledge differed significantly across several demographic characteristics (Figure 2). Participants residing in the United States scored higher than those in China (Mann–Whitney U = 59.50, p < .001; Figure 2A), while suburban participants scored higher than urban participants (U = 91.00, p = .003; Figure 2B). Significant differences were also observed across age groups (Kruskal–Wallis H = 14.15, p < .001; Figure 2C) and educational levels (H = 13.07, p = .001; Figure 2D). Participants who reported school or formal education as an information source demonstrated significantly higher environmental knowledge than those who did not (U = 360.00, p = .004; Figure 3). No significant differences were observed for social media, news media, documentaries, or friends and family.

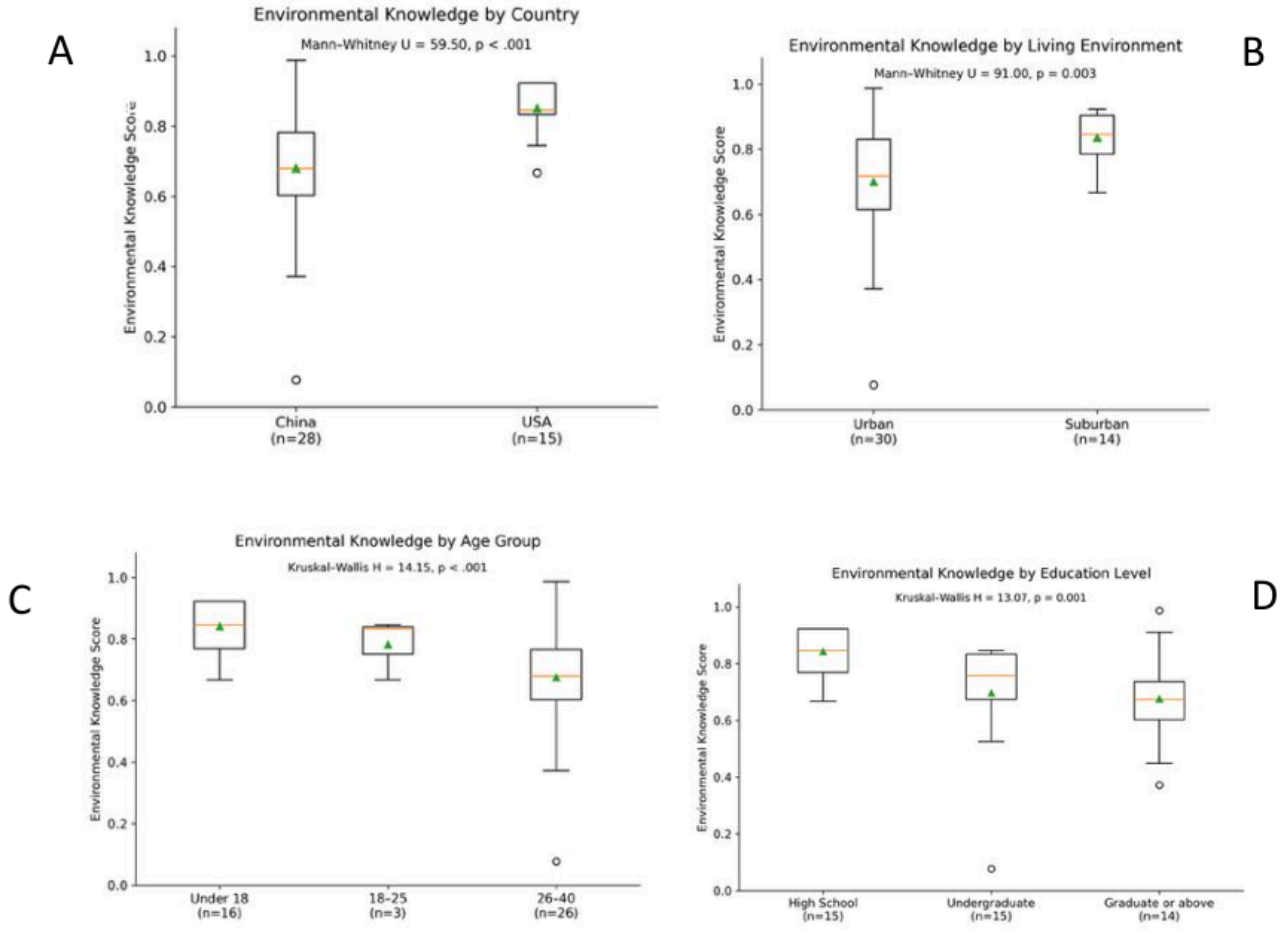

Figure 2. Environmental knowledge across demographic groups

Boxplots showing environmental knowledge scores by (A) country, (B) living environment, (C) age group, and (D) education level. Boxes represent the interquartile range (IQR), center lines indicate medians, whiskers extend to 1.5 × IQR, and circles indicate outliers.

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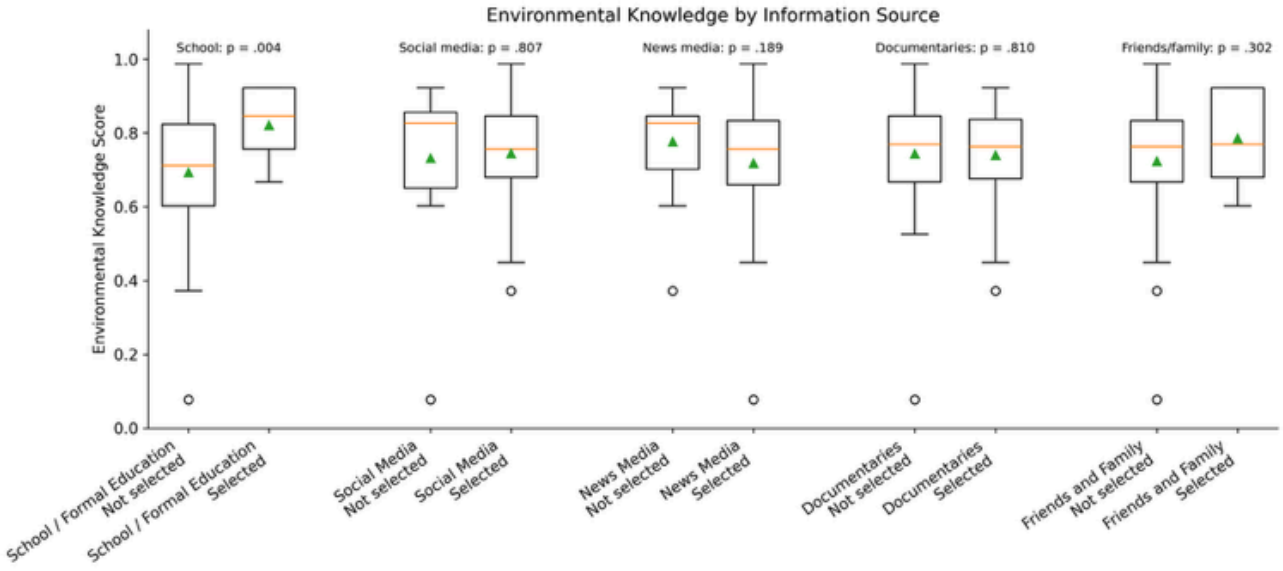

Figure 3. Environmental knowledge by information source

Environmental knowledge scores for participants who selected ("Selected") or did not select ("Not selected") each information source.

3.5. Relationships among environmental knowledge, attitudes, engagement, and environmental exposure

Environmental knowledge was positively associated with conservation attitudes (Spearman's $\rho = 0.30$, $p < .05$) but not environmental engagement ($\rho = 0.28$, $p > .05$; Figure 4A). In contrast, conservation attitudes showed a strong positive association with environmental engagement ($\rho = 0.83$, $p < .001$). Spending more time in natural environments ($\rho = 0.444$, $p = .007$) and greater exposure to environmental topics ($\rho = 0.367$, $p = .013$) were positively associated with environmental knowledge, whereas self-reported interest in nature was not ($\rho = 0.082$, $p = .594$; Figure 4B).

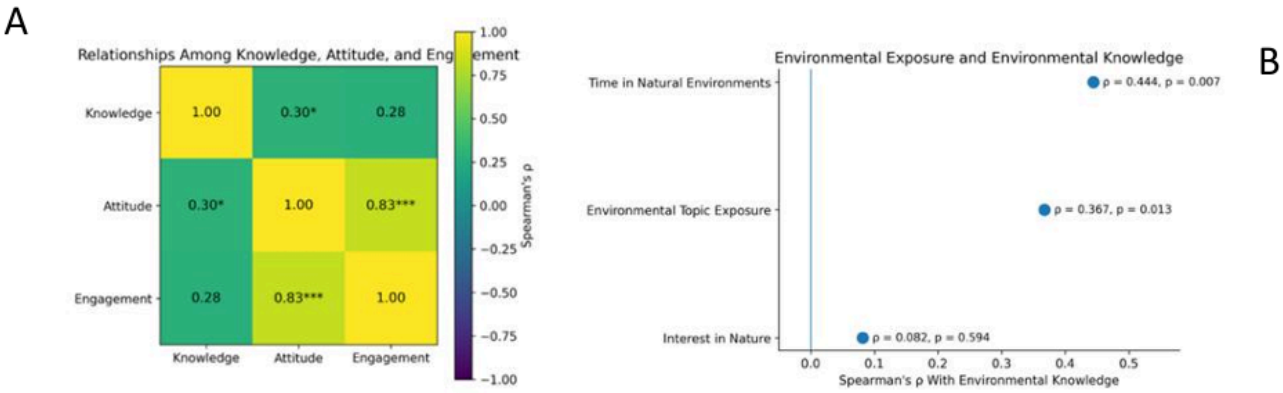

Figure 4. Correlations among environmental knowledge, conservation attitudes, environmental engagement, and environmental exposure

(A) Spearman's rank correlation matrix among environmental knowledge, conservation attitudes, and environmental engagement. (B) Spearman's rank correlations between environmental knowledge and environmental exposure variables.

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4. Discussion

Our study examined public perceptions of environmental threats to bird conservation and explored how environmental knowledge relates to demographic characteristics, education, conservation attitudes, and environmental engagement. Overall, participants demonstrated relatively strong knowledge of basic ecological concepts. However, knowledge of anthropogenic environmental impacts remained comparatively weaker, particularly regarding artificial light pollution and anthropogenic noise, indicating an important knowledge gap between basic ecological concepts and human-driven environmental impacts. Although most participants recognized urbanization and habitat loss as major threats to birds, climate change was identified by only 42.2% of respondents. This suggests that participants more readily recognize local environmental threats than broader ecological processes. Future environmental education may therefore benefit from placing greater emphasis on the ecological impacts of climate change. Unexpectedly, younger participants and those with only a high school education achieved higher environmental knowledge scores than undergraduate or graduate participants. Because many younger participants were from the United States, this pattern may reflect differences in environmental education systems. Participants residing in the United States and suburban environments also demonstrated significantly higher knowledge scores. Future studies with larger and more geographically diverse samples are needed to further examine these demographic differences. Among all information sources examined, school or formal education was the only source significantly associated with higher environmental knowledge. In contrast, documentaries, news media, social media, and friends or family showed no significant associations, suggesting that structured education provides more effective environmental learning than informal information sources. Correlation analyses indicated that environmental knowledge was not significantly associated with environmental engagement, whereas conservation attitudes showed a strong positive relationship with environmentally responsible behavior. Participants who spent more time in natural environments also demonstrated higher environmental knowledge, suggesting that direct environmental experiences may be more effective than passive interest alone. Environmental education may therefore benefit from combining classroom instruction with hands-on experiences in nature. Several limitations should be acknowledged. The relatively small sample size and uneven demographic representation limit the generalizability of the findings, and the cross-sectional design prevents causal inference. Future studies should include larger and more representative samples to further examine how environmental education influences conservation attitudes and pro-environmental behavior.

5. Conclusion

This study examined public understanding of bird ecology and the relationships among environmental knowledge, conservation attitudes, environmental engagement, and environmental exposure. Participants demonstrated strong knowledge of many ecological concepts but showed important gaps regarding anthropogenic threats, particularly climate change, artificial light pollution, and anthropogenic noise. Environmental knowledge was associated with formal education and direct environmental exposure but not with environmental engagement. In contrast, conservation attitudes showed a strong relationship with environmentally responsible behavior. These findings suggest that effective environmental education should extend beyond improving factual knowledge by also fostering positive conservation attitudes through meaningful learning experiences. Future studies with larger and more diverse samples are needed to further examine how environmental education promotes long-term conservation behavior.

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