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Identifying Local Potentials in Lampung Province as a Biology Learning Resource

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Abstract: The integration of local potential into biology education is essential for enhancing student engagement, creativity, and environmental awareness. However, its implementation remains suboptimal in various regions, including Lampung Province. This study aims to identify and analyze the diversity of bird species in Way Kambas National Park (WKNP) as a potential biology learning resource. Using a descriptive exploratory approach with the point count method, observations were conducted at three locations within WKNP, identifying 33 bird species from 21 families, with a total of 727 individuals. The diversity index values indicate moderate species richness, highlighting the park's ecological significance. Compared to previous studies, which primarily focused on megafauna, this research emphasizes avian biodiversity as a novel approach to contextual learning. The findings demonstrate that incorporating local avifauna into the curriculum enhances students' understanding of ecosystem dynamics, biodiversity conservation, and species adaptation. This study provides practical implications for biology education by promoting field-based learning, fostering conservation awareness, and encouraging schools to integrate local biodiversity into teaching materials. Strengthening collaboration between educators, conservationists, and local communities is crucial for maximizing the educational benefits of regional biodiversity.

Keywords: Avifauna; Biology; Learning Resource; Lampung; Local Wisdom.

Introduction

The advancement of science and technology in the era of globalization demands all sectors of life to continuously adapt and compete with the changing needs of the times. High-quality resources play a vital role in driving progress in science and technology across various fields, including education. One of the government's efforts to achieve educational goals in Indonesia is the enhancement of school curricula (Ivana et al., 2021). The 2013 curriculum, which is skills-based, emphasizes mastery of specific skills by students. A key characteristic of this curriculum is the effective utilization of all available learning resources. Such resources are crucial not only for enriching and maintaining the breadth of learning but also for enhancing learning activities and creativity. They are highly beneficial for both teachers and students (Amallia & Advinda, 2020; Suwarni, 2015).

Biology is a subject inherently connected to daily life, as its research topics involve all living organisms, including students themselves, the living organisms in their surroundings, and their interactions with the environment (Aroyandini et al., 2020; Christopher & Alia Leemarc, 2021; Mukagihana et al., 2021). Given this close relationship to everyday life, it is essential for students to master biology to utilize it as a practical resource in life. Students are not only expected to grasp biological concepts verbatim during school lessons but

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also to apply them in real-life contexts, such as problem-solving (Banerjee & Ghose, 2018; Elisetana et al., 2023). Biology education should provide a platform for students to study themselves and their environment while offering prospects for further application in daily life. The learning process emphasizes direct experiences to foster scientific exploration skills and a deeper understanding of the natural environment (Erwinsyah & Due, 2022; Green et al., 2022). By focusing on inquiry-based processes and action-oriented learning, biology education aims to provide students with comprehensive insights into their natural surroundings, underscoring the importance of linking school lessons with real-world experiences (Mendala & Suryadarma, 2019).

However, the low quality of biology instruction in certain regions highlights that the incorporation of local potential into teaching practices remains suboptimal. Teachers often rely solely on textbooks and conventional teaching media such as PowerPoint presentations, resulting in lessons that lack engagement and real-world relevance. In regions like Lampung, the abundant local potential as a learning resource has not been fully utilized. This presents a challenge for educators to integrate biodiversity and local cultural heritage into biology lessons to enhance student engagement, creativity, and environmental awareness (Nurhidayati & Khaeruman, 2017).

Local potential refers to the unique resources of a region that can serve as independent learning materials for students (Destiara, 2020). Integrating local potential into education enables students to not only grasp theoretical knowledge but also develop the ability to apply it in real-life situations. Lampung Province, rich in biodiversity, offers numerous opportunities, such as Way Kambas National Park, to be utilized as local potential-based biology learning resources. Introducing local potential in lessons can also raise student awareness of environmental conservation and local cultural preservation. This research aims to identify various local potentials that can be developed into educational materials (Nurhidayati & Khaeruman, 2017). Indonesia, a country with one of the world's highest biodiversity levels, ranks second globally after Brazil (Leksikowati et al., 2019). Its rich biodiversity is crucial for sustaining human life.

Lampung Province, located at the southern tip of Sumatra Island, boasts abundant biodiversity, partly due to its many forests designated as nature reserves and conservation areas, maintaining the integrity of its ecosystems. Lampung's local potentials encompass 18 notable resources, including natural and conservation sites like Pahawang Island, Sari Ringgung Beach, the Marine Aquaculture Fisheries Center, and TAHURA in Pesawaran Regency; Pasir Putih Beach in South Lampung; Kiluan Bay; Batu Tegi Protected Forest in Tanggamus Regency; and Way Kambas National Park in East Lampung. Additionally, the region offers attractions like Lembah Hijau Wildlife Park and Gita Persada Butterfly Park in Bandar Lampung. Local culinary delights include Seruit, Sekubal, Benjak Enjak, and Sambal Tempoyak, while cultural heritage features Sembah Dance/Siger Pengunten, Bedana Dance, Tapis Cloth, and Begawi.

Studies show that the implementation of local potential in Lampung's education remains suboptimal, with teachers relying heavily on textbooks and conventional methods even tough utilizing local potential in biology learning is crucial in helping students connect their learning with everyday life (Wulandari & Djukri, 2021). For example, (Haka et al., 2021) highlights the need to incorporate local wisdom into biology teaching to enhance student motivation and understanding. By developing local wisdom-based e-modules, students can engage more deeply with the material, explore the potential of their surrounding environment, and improve their learning outcomes in a relevant and engaging educational context. The selection of birds as a focus for research in Way Kambas National Park (WKNP) is based on their critical ecological roles in maintaining ecosystem balance. Birds act as sensitive biological indicators of environmental changes, reflecting the health of an area's ecosystem (Widodo & Sulystiadi, 2016). Additionally, they contribute significantly to ecosystems through pollination, seed dispersal, and insect population control (Kamaluddin et al., 2019). The avian diversity in WKNP, which includes endemic and protected species, makes it an invaluable resource for conservation and environmental education.

Previous research in WKNP has largely focused on megafauna like elephants and rhinos, while avifauna, which plays a vital role in the ecological chain, has received less attention (Siahaan et al., 2013). Birds, being relatively easy to observe and identify compared to other fauna, are ideal subjects for initial explorations of local potential as biology learning materials. Incorporating research findings on avian diversity into local potential-based teaching materials can enrich the curriculum and enhance student awareness of conservation (Nurhidayati & Khaeruman, 2017). This study aims to analyze bird species diversity in WKNP as part of efforts to utilize local potential in biology education. By integrating local biodiversity into the curriculum, this research seeks to not only improve the quality of teaching but also support biodiversity conservation by raising student awareness.

Method

This study employs a descriptive exploratory approach to analyze the local potential of biodiversity in

Way Kambas National Park (WKNP) as a learning resource for biology education. A descriptive exploratory design is appropriate for identifying and describing natural phenomena without making broad generalizations (Sugiyono, 2017). The research aims to assess avian diversity within WKNP and explore its potential integration into the biology curriculum.

Bird observation was conducted using the point count method, which is widely applied in avian surveys due to its effectiveness in estimating species diversity and population density in specific habitats (Bibby, 2000). This method was chosen because it allows systematic data collection across different environments while minimizing disturbance to bird species. It also enables researchers to gather information on bird presence, abundance, and behavior within a fixed observation radius.

The selection of observation points was based on ecological considerations to ensure habitat diversity representation. Observations were carried out in three different locations within WKNP, including forested areas representing primary and secondary forests, grasslands with open vegetation that provide habitats for grassland-dependent birds, and wetlands comprising riverbanks and marshy areas that serve as critical habitats for waterbirds and migratory species. Each observation point was surveyed three times to ensure data reliability and minimize potential biases. Observers utilized binoculars (Nikon Prostaff 10x42) and field guides (MacKinnon & Phillipps, 1993) to accurately identify bird species. The recorded data included species presence, number of individuals, behaviors, and environmental conditions.

To complement the observational data, semi-structured interviews were conducted with multiple respondent groups to gain deeper insights into biodiversity management and its integration into biology education. Interviews were held with WKNP management and conservation experts to understand biodiversity conservation efforts and the challenges associated with incorporating local biodiversity into education. Biology teachers from several senior high schools were also interviewed to explore how local biodiversity has been integrated into the curriculum, the challenges they face, and the most effective teaching strategies they have implemented. Additionally, interviews with high school students were conducted to assess their motivation and interest in studying biology through lessons that incorporate local biodiversity.

The interview process was guided by several key questions, including how biodiversity, particularly avian diversity, is managed in WKNP, what challenges are encountered in utilizing local biodiversity as an educational resource, and how students perceive learning biology through local environmental examples. The data obtained from both observations and interviews were analyzed using data reduction, data display, and conclusion-drawing techniques (Miles & Huberman, 1994). Bird observation data were interpreted descriptively based on species richness and habitat characteristics, while interview responses were transcribed, coded, and categorized into themes related to biodiversity education, conservation awareness, and pedagogical strategies.

Through this approach, the study provides a comprehensive analysis of how local biodiversity, particularly avian diversity in WKNP, can be effectively integrated into biology education. The findings aim to enhance learning outcomes while fostering greater environmental conservation awareness among students and educators.

Result and Discussion

Way Kambas National Park at the Elephant Training Center

Way Kambas National Park features a lowland ecosystem that includes various types of habitats, such as grasslands, secondary forests, and swamps. This diverse ecosystem serves as the habitat for various species of Sumatran elephants (Elephas maximus sumatranus) and birds. According to Kamaluddin et al. (2019), the selection of a habitat by Sumatran elephants depends on several factors, including the availability of feeding grounds, canopy cover for shelter, and access to water sources. Furthermore, Kamaluddin et al. (2019) observe that the Way Kambas area is inhabited by bird species that feed on nectar, insects, and seeds, belonging to families such as Pycnonotidae, Ploceidae, Nectariniidae, Picidae, Cisticolidae, Cuculidae, and Columbidae. The swamp habitat, in particular, is dominated by water birds from the Ciconiidae and Ardeidae families. These bird habitats possess distinct characteristics, serving essential functions for feeding, shelter, and breeding. A total of 33 bird species with 727 individuals (N) have been recorded in the Elephant Training Center (PLG) of Way Kambas National Park (Table 1).

Table 1. Bird species at the Elephant Training Center of Way Kambas National Park

Species	Scientific Name	Familia	Observation Station			Amount
			PC 1	PC 2	PC 3	
Bangau Tongtong	*Letoptilos javanicus*	Ciconiidae	0	0	1	1
Bentet Kelabu	*Lanius schach*	Laniidae	0	2	0	2

Species	Scientific Name	Familia	Observation Station			Amount
			PC 1	PC 2	PC 3	
Bondol Haji	*Lonchura maja*	Ploceidae	0	104	0	104
Bondol Peking	*Lonchura punctulata*	Ploceidae	0	12	0	12
Brinji Kelabu	*Hypsipetes flavala*	Pycnonotidae	1	0	0	1
Bubut Alang-alang	*Centropus bengalensis*	Cuculidae	0	3	0	3
Burung Gereja Erasia	*Passer montanus*	Ploceidae	8	8	0	16
Burung Madu Kelapa	*Anthreptes malacensis*	Nectariniidae	2	0	0	2
Burung Madu Polos	*Anthreptes simplex*	Nectariniidae	1	0	0	1
Burung Madu Sriganti	*Nectarinia jugularis*	Nectariniidae	3	0	0	3
Cabai Jawa	*Dicaeum trochileum*	Dicaeidae	15	0	0	15
Caladi Tilik	*Picoides moluccensis*	Picidae	9	2	0	11
Cangak Merah	*Ardea purpurea*	Ardeidae	0	0	5	5
Cekakak Belukar	*Halcyon smyrnensis*	Alcedinidae	0	0	3	3
Cekakak Sungai	*Todirhamphus chloris*	Alcedinidae	0	15	8	23
Cinenen Kelabu	*Orthotomus ruficeps*	Cisticolidae	5	2	0	7
Cinenen Merah	*Orthotomus sericeus*	Cisticolidae	4	0	0	4
Cucak Kutilang	*Pycnonotus aurigaster*	Pycnonotidae	28	34	0	62
Gelatik Batu Kelabu	*Parus major*	Paridae	2	0	0	2
Kapasan Kemiri	*Lalage nigra*	Campephagidae	2	0	0	2
Kepudang Kuduk Hitam	*Oriolus chinensis*	Oriolidae	0	1	0	1
Kirik-kirik Laut	*Merops philippinus*	Meropidae	0	0	16	16
Kuntul Kerbau	*Bubulcus ibis*	Ardeidae	0	109	98	207
Layang-layang Rumah	*Delichon dasypus*	Hirundinidae	0	47	82	129
Perenjak Rawa	*Prinia flaviventris*	Cisticolidae	0	1	0	1
Perkutut Jawa	*Geopelia striata*	Columbidae	8	13	0	21
Punai Siam	*Treron bicincta*	Columbidae	2	0	0	2
Raja Udang Meninting	*Alcedo meninting*	Alcedinidae	0	0	9	9
Sikatan Kepala Abu	*Culicicapa ceylonensis*	Stenostiridae	2	0	0	2
Srigunting Bukit	*Dicrurus remifer*	Dicruridae	2	0	0	2
Tikusan Kerdil	*Porzana pusilla*	Rallidae	0	0	8	8
Walet Sarang Putih	*Hydrochous gigas*	Apodidae	0	4	42	46
Wiwik Kelabu	*Cacomantis merulinus*	Cuculidae	4	0	0	4
	Amount		98	357	272	727

Based on Table 1, all the bird species identified in this study are endemic to Sumatra, Java, Kalimantan, and Bali. The species diversity and abundance of birds observed at the study sites exhibit distinct variations and unique characteristics.

Bird Diversity in Way Kambas National Park (TNWK)

Based on Table 1, all the bird species identified in this study are endemic to Sumatra, Java, Kalimantan, and Bali. The species diversity and abundance of birds observed at the study sites exhibit distinct variations and unique characteristics. The cattle egret (*Bubulcus ibis*) is the most commonly encountered species at the observation sites due to its preference for wetland habitats, particularly in swamp areas and lowland regions with water bodies (Nugroho, 2015). Its behavior of frequently associating with elephants results in increased activity in grasslands and swamps, where it feeds on insects and small animals. Meanwhile, the lesser adjutant (*Leptoptilos javanicus*), a protected species under the Indonesian Ministry of Environment and Forestry Regulation No. 92 of 2018 on Protected Plants and Animals, can be found in swamp areas.

The grassland area (PC 2) emerged as the most frequently observed location for bird presence, primarily dominated by species from the Ploceidae family, such as the white-headed munia (*Lonchura maja*) and the spotted munia (*Lonchura punctulata*). According to (Riefani et al., 2019), these birds are commonly found feeding on seeds or small grains from grass growing in open fields or grasslands. The diversity index values recorded at different stations were 2.363 with 17 species at station one, 1.875 with 15 species at station two, and 1.648 with 10 species at station three. Overall, bird species diversity at the observation sites is categorized as moderate.

Relationship Between Bird Diversity and Ecosystem Conditions

The findings of this study suggest that the number of species directly influences the diversity index. Station one recorded the highest diversity, while station three exhibited the lowest, likely due to the greater number of bird species found in the former and fewer species in the latter. The presence of bird species is closely linked to habitat conditions at each site, with the park area offering a more diverse food supply compared to the grassland and swamp areas.

This aligns with research by Widodo & Sulystiadi (2016), which found that bird diversity tends to correlate with abundant food resources and vegetation components in a given habitat. (Putri, 2015) also asserts that the continuous availability of food in a specific area can influence bird presence and their tendency to settle in a given location. The level of bird species diversity can be assessed based on species presence and individual abundance. High diversity reflects a wide distribution of species and a stable community, whereas low species distribution and a disrupted community result in lower diversity (Nugroho, 2015).

Beyond food availability and habitat conditions, human interaction may also impact the abundance of birds in an ecosystem (Siahaan et al., 2013). Way Kambas National Park (TNWK) boasts a rich diversity of birds, with 33 species from 21 families recorded across various ecosystems, including grasslands, secondary forests, and swamps, each providing unique habitats. The bird diversity in TNWK includes families such as Ploceidae, Nectariniidae, and Ardeidae, which play vital roles in the ecosystem through processes such as pollination, seed dispersal, and insect population control.

Utilization of Bird Diversity as a Biology Learning Resource

This biodiversity can serve as a valuable resource for teaching biology, particularly in topics related to ecosystems, biodiversity, and species adaptation. For instance, the cattle egret (*Bubulcus ibis*), which has the highest individual abundance, can illustrate species-environment interactions, such as its relationship with grasslands and swamps as primary habitats. Similarly, nectar-feeding birds from the Nectariniidae family, such as the olive-backed sunbird (*Anthreptes malacensis*), offer an example for studying morphological adaptations that allow access to specific food sources. Furthermore, students can explore the concept of biodiversity by analyzing data, such as the Shannon-Wiener diversity index, which reflects bird diversity at three observation stations. This data provides a real-world context for developing ecological analysis skills, including understanding how species and individual numbers affect ecosystem stability.

Implications for Education and Environmental Conservation

Bird observations in TNWK are also crucial for discussions on biodiversity conservation. Species like the lesser adjutant (*Leptoptilos javanicus*), which is protected by government regulations, can stimulate discussions on the importance of conserving endangered species. By studying these birds, students not only grasp biological concepts but also gain awareness of their responsibility in preserving biodiversity.

Integrating the findings of this research into biology education through local potential-based learning approaches, such as field observation projects, case study reports, or group discussions, can provide students with relevant and contextual learning experiences. These approaches enhance their understanding of the role of birds in maintaining ecosystem balance and environmental sustainability.

Interviews with TNWK Manager, Local Community, and High School Teachers and Students Around TNWK

The interviews with the management of Way Kambas National Park (TNWK), local communities, and high school educators provided valuable insights into the ecological and educational significance of bird diversity in TNWK. The park management emphasized the crucial role of birds in ecosystem balance through seed dispersal and insect population control. They also highlighted ongoing conservation efforts, including habitat protection, strict regulations against poaching, and environmental education programs for the local community. These insights align with the potential integration of TNWK's biodiversity into biology education by promoting awareness and fostering conservation-oriented behavior among students.

Interviews with local community members revealed their traditional ecological knowledge regarding bird species in grasslands and wetlands, such as the cattle egret (*Bubulcus ibis*) and white-headed munia (*Lonchura maja*). While they acknowledge the role of birds in pest control, there remains a lack of awareness regarding the broader importance of conservation. Many community members expressed interest in educational initiatives that could enhance their understanding of biodiversity. This presents an opportunity to develop community-based learning programs where students collaborate with local residents in bird-watching activities, habitat monitoring, and conservation workshops. Such experiential projects would not only deepen students' understanding of biodiversity but also strengthen their engagement with the local environment.

Interviews with high school teachers and students from SMA Negeri 1 Labuhan Ratu demonstrated that

some aspects of TNWK's bird diversity have been incorporated into the curriculum, particularly in discussions on ecosystems and biodiversity. Teachers noted that using local examples made lessons more engaging, while students expressed greater motivation when learning was connected to their surroundings. However, challenges remain in accessing detailed research data and structured educational materials. To address this gap, TNWK's biodiversity data could be formalized into structured learning modules or field-based projects. For instance, students could participate in biodiversity monitoring projects where they record bird species, analyze ecological interactions, and present their findings in class discussions. Such projects align with experiential learning approaches, which have been shown to enhance critical thinking skills and scientific literacy.

The integration of TNWK's biodiversity into biology education can be further reinforced through interdisciplinary projects that combine ecology, conservation science, and environmental ethics. For example, a project-based learning module could involve students designing conservation awareness campaigns, creating educational posters about TNWK's bird species, or developing digital storytelling projects that highlight the ecological importance of local biodiversity. These initiatives would not only enrich biology education but also instill a sense of environmental stewardship among students.

From an educational perspective, contextual learning approaches that incorporate local biodiversity have been demonstrated to enhance student engagement and comprehension. Research by Suwarni (2015) suggests that integrating local resources into the curriculum fosters deeper understanding and critical thinking. The findings from this study underscore the need for structured learning materials that connect biodiversity data from TNWK to biology education. Future efforts should focus on developing comprehensive learning modules, field observation guides, and interactive digital resources that enable students to explore local biodiversity in meaningful ways. By bridging ecological knowledge with educational practice, TNWK's bird diversity can serve as both a conservation priority and an invaluable learning resource for the next generation.

Conclusion

This study identified the bird diversity in Way Kambas National Park (WKNP) and its potential as an educational resource for biology lessons based on local potential. A total of 33 bird species from 21 families were recorded, demonstrating moderate diversity as indicated by Shannon-Wiener index values. Insights gathered from interviews with WKNP managers, local communities, and educators emphasized the ecological and educational importance of this biodiversity. Iconic species, such as the cattle egret (*Bubulcus ibis*) and the brown-throated sunbird (*Anthreptes malacensis*), highlight essential ecological processes like pollination and insect control. These examples can be effectively integrated into biology lessons to teach concepts such as ecosystems, food chains, and species adaptations. Incorporating local biodiversity into the curriculum, particularly through field observations and data analysis, enriches students' understanding of biology while fostering environmental awareness. Despite its potential, this approach faces challenges, including limited access to research data and the need for teacher training to develop innovative teaching methods. Enhancing conservation efforts at WKNP through stricter habitat protection and collaboration with schools can support field-based education while fostering partnerships with local communities to raise awareness about the ecological value of bird diversity. Schools can further integrate local biodiversity into teaching materials, such as modules featuring WKNP bird diversity. Continued research on the relationship between bird diversity and ecosystem components, alongside studies on the effectiveness of local potential-based learning, can provide valuable insights. Government support through funding, infrastructure, and environmentally focused policies can further amplify these efforts, ensuring biodiversity's role in education and conservation.

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Conceptualization was carried out by both authors; methodology, software, formal analysis, investigation, writing resources, and data curation were handled by the first author; supervision was undertaken by the second author. Both authors have read and agreed to the published version of the manuscript. All authors have read and agreed to the published version of the manuscript.

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The authors declare no conflict of interest.

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