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Identification of Fauna Diversity from Fishermen's Catches on Depok Beach, Bantul, and Analysis of Its Potential as a Contextual Biology Learning Resource for Senior High School Phase E

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ABSTRACT

Biology learning in senior high schools still relies heavily on textbooks and has not optimally utilized local environmental resources as contextual learning materials. Therefore, identifying local biological potential is important to support the implementation of contextual learning in the Merdeka Curriculum. This study aimed to identify the diversity of fauna caught by fishermen at Depok Beach, Bantul, and analyze its potential as a contextual biology learning resource for Phase E. A qualitative descriptive approach with an exploratory design was employed. Data were collected through observation, semi-structured interviews, documentation, and literature review. The feasibility of the identified fauna as learning resources was analyzed based on content relevance, pedagogical value, and contextuality. The results showed that fishermen's catches consisted predominantly of fish, crustaceans, and mollusks with diverse morphological characteristics and ecological roles. These fauna are relevant to Biology topics, including biodiversity, classification, ecosystems, and ecological interactions. In addition, they possess strong contextual value because they originate from students' surrounding environment and can be integrated into inquiry-based and field-based learning activities. Therefore, the fauna diversity of Depok Beach has the potential to serve as a feasible contextual biology learning resource and provide a foundation for developing teaching materials based on local coastal potential.

1. Introduction

Biology education at the senior high school level is strategic in equipping students with an understanding of biodiversity and its relationship to the surrounding environment. Modern biology learning requires students not only to grasp concepts

theoretically but also to relate concepts to real-life phenomena through a contextual, environmentally based method (Fikriyah et al., 2024). This is in line with the demands of 21st-century learning, which emphasize critical thinking, problem-solving, and environmental literacy. The reality on the ground shows that biology learning tends to be oriented toward textual delivery and underutilizes the potential of the surrounding environment as a learning resource. The underutilization of locally sourced learning resources leads to less meaningful, contextually relevant learning for students (Fajeriadi et al., 2025). This situation contributes to low student engagement and a less-than-optimal understanding of biological concepts, particularly biodiversity.

Although biodiversity is one of the core topics in Biology learning, instructional practices in many schools still rely predominantly on textbooks and teacher explanations. As a result, learning often becomes less contextual and students have limited opportunities to connect biological concepts with phenomena in their surrounding environment. The Merdeka Curriculum encourages the utilization of local potential as authentic learning resources that can support meaningful learning experiences and strengthen students' understanding of biological concepts. Local potential, in the form of natural resources in the surrounding environment, plays a crucial role as a learning resource. This can help students understand biological concepts in a more concrete and applicable way. Local potential is used as an engaging, contextual learning tool that can increase students' motivation to learn and environmental awareness. Furthermore, it has been proven to improve student learning outcomes, attitudes, and skills significantly (Fajeriadi et al., 2025).

A local potential resource for learning in biology is coastal fauna diversity. Coastal ecosystems harbor a high diversity of organisms, including fish, crustaceans, and mollusks, each with distinct morphological characteristics, habitats, and ecological roles. Fishermen's activities in coastal areas, such as at Depok Beach, Bantul, Yogyakarta, produce a variety of fauna species that can serve as real-life and contextual learning objects for students. The use of these real-life objects allows students to make direct observations, thereby enhancing science process skills and deepening conceptual understanding. Studies on coastal fauna diversity are dominated by descriptive-ecological methods and have not been widely related to educational contexts. Conversely, publications on learning resources based on local potential are limited to identifying general potential and have not specifically addressed fishermen's catches as a biology learning resource at the senior high school level (Wulandari & Djukri, 2021). Additionally, the integration of local coastal potential into biology learning, in line with the latest curriculum, remains suboptimal.

A recent study shows that biology learning that integrates local potential through innovative models, such as discovery learning or locally-based STEM, can have the potential to support the development of critical thinking skills and creativity (Sulaeman et al., 2024). However, implementing this method, which uses the real-world context of fishermen's catches as a direct learning resource, remains limited. Based on the existing gap, this study was conducted not only to identify the diversity of fauna caught by fishermen at Depok Beach, Bantul, but also to analyze

the feasibility of these fauna as contextual Biology learning resources that are aligned with the Learning Outcomes (CP) of Phase E in the Merdeka Curriculum. The results are expected to contribute to the development of locally based biology learning resources that are relevant, contextual, and meaningful for students.

2. Methodology

Study Type and Approach

A qualitative descriptive method was used to systematically describe the fauna diversity caught by fishermen at Depok Beach, Bantul, and analyze the characteristics, habitats, ecological roles, and potential as a biology learning resource. The design was exploratory, as data were collected directly in the field without any specific treatment of the objects. Furthermore, this study adopted a contextual method by connecting field results to the biology learning needs of the Merdeka Curriculum Phase E.

Study Location and Time

The study was conducted in the Depok Beach area of Bantul, Yogyakarta, a center of fishing activity and seafood trade. Data were collected in August 2025 at specific times, primarily in the morning when fishermen landed and in the afternoon during distribution of the catches. This selection of times was intended to obtain a greater variety of fauna species, thereby ensuring a more representative sample.

Study Subjects and Objects

The subjects were fishermen and the fishing activities at Depok Beach, while the objects were the fauna species, such as fish, crustaceans, and mollusks. This study examined the morphological characteristics, classification, habitat, distribution, and ecological roles of each fauna, including the potential use as a biology learning resource.

Data Collection Techniques

Data were collected using several techniques, namely observation, interviews, documentation, and literature review. Observations were conducted directly at the study location to identify the fauna species and the morphological characteristics. Subsequently, the species were grouped based on simple classifications. Semi-structured interviews were conducted with fishermen to obtain information on the dominant species caught, the habitats, spawning seasons, and the utilization of these fauna. The captured fauna were photographed, and important data, such as local names and the number of species, were recorded. Meanwhile, a literature review was used to support the scientific identification of the fauna and explain their characteristics and ecological roles based on reliable sources.

Study Instruments

The instruments used include observation sheets, interview guidelines, and documentation tools such as cameras or smartphones. The data obtained were then analyzed through several stages, namely reduction, presentation, and conclusion drawing. Reduction entailed selecting and simplifying details to correspond with the study focus. Subsequently, the data were presented in tables and narrative descriptions for ease of understanding. Analysis was conducted descriptively by grouping fauna through classification, describing morphological characteristics, and examining the habitats and ecological roles. Observation indicators can be seen in Table 1 while structured interview questions can be seen in Table 2.

Table 1. Observation Indicators

Aspect	Indicator
Fauna diversity	Species identified from fishermen's catches
Morphology	External characteristics of fauna
Habitat information	Source habitat according to fishermen
Ecological role	Role in coastal ecosystem
Learning potential	Relevance to Biology concepts

Table 2. Interview Questions

No	Question
1	What species are most frequently caught?
2	When is the peak catching season?
3	Where are the species commonly found?
4	What ecological characteristics are known by fishermen?
5	Which species are considered economically important?

Data Validity

Data validity was ensured through triangulation techniques by comparing information obtained from various collection methods, such as observation and interviews. It also includes comparing information from several sources and across different observation times. The study procedure began with the preparation stage, followed by field data collection, processing, and analysis, as well as the interpretation and reporting of results. This method was expected to provide a comprehensive overview of coastal fauna diversity and its relevance as a contextual and meaningful source for biology learning.

Analysis of Educational Potential

The feasibility of identified fauna as biology learning resources was analyzed using three criteria adapted from local-potential-based learning resource studies, namely content relevance, referring to the suitability of fauna characteristics and ecological roles with Biology Learning Outcomes (CP) in Phase E. Pedagogical value, referring to the potential of fauna objects to support observation, classification, inquiry, and scientific investigation activities. Contextuality, referring to the

closeness of learning objects to students' daily environment and local potential. The analysis was conducted descriptively by matching the observation results with the learning outcomes and essential concepts in Phase E Biology.

To strengthen the educational relevance of the findings, the identified fauna were further mapped into potential learning resource components, including learning objectives, student worksheets (LKPD), inquiry activities, and learning materials aligned with the Biology Learning Outcomes (CP) of Phase E. This mapping was conducted descriptively based on curriculum-document analysis and local-potential-based learning resource frameworks.

3. Results and Discussion

Results

General Overview of Depok Beach

Depok Beach is a coastal area located in Bantul Regency, Yogyakarta, in the southern part of Java Island, directly bordering the Indian Ocean. Geographically, it is located near the Opak River estuary, a key feature of the area. The presence of the estuary gives Depok Beach a complex ecosystem, combining marine, estuarine, and sandy coastal environments. Morphologically, this area is dominated by black-sand beaches with relatively large and powerful ocean waves, a common characteristic of the southern coast of Java. These conditions also influenced the species of organisms that lived and thrived in the area.

As an economically active coastal area, Depok Beach is known as a center of traditional fishing. This activity occurs almost daily, especially in the morning and evening, when fishermen depart and return to sea. The fishing gear used generally includes nets (gill nets and trammel nets) and small motorized boats. The catches of fishermen in this area were quite diverse, including various pelagic and demersal fish, such as tuna, mackerel, and snapper, as well as crustaceans (shrimp), cephalopods (squid), and several species of mollusks. This diversity reflects the richness of coastal fauna and offers potential for further study, both from a biological perspective and as a contextual learning resource.

The environmental conditions at Depok Beach play a significant role in determining fauna diversity. The dominant substrate of this area is fine to medium-textured sand, influenced by strong ocean wave dynamics. Furthermore, the presence of the Opak River estuary influenced the salinity and nutrient content of the surrounding waters, creating a habitat that supports a variety of aquatic organisms. The interaction between seawater and freshwater in the estuary also allowed for the discovery of species tolerant to salinity variations. Based on these dynamic environmental conditions, Depok Beach is a potential location for studying coastal fauna diversity, particularly as it relates to fishermen's catches.

Fauna Diversity of Fishermen's Catches

The observation results showed that fishermen's catches at Depok Beach, Bantul, consisted predominantly of fish, crustaceans, and mollusks. The identified fish included tuna (*Euthynnus affinis*), snapper (*Lutjanus* sp.), tetengkek (*Megalaspis cordyla*), black pomfret (*Parastromateus niger*), talang-talang (*Scomberoides lysan*), and senangin (*Eleutheronema tetradactylum*). The crustacean group was represented mainly by tiger shrimp (*Penaeus monodon*), while the mollusk group included squid species such as *Uroteuthis duvaucelii* and *Ommastrephes bartramii*. The diversity of these fauna reflects the productive coastal ecosystem of Depok Beach and the influence of marine and estuarine environments. Table 3 presents the main characteristics of the identified fauna and their relevance to Biology learning in Phase E.

Table 3. Characteristics and Educational Relevance of Identified Fauna

Fauna Group	Representative Species	Main Characteristics	Ecological Role	Relevance to Biology Learning
Fish	<i>Euthynnus affinis</i> , <i>Lutjanus</i> sp., <i>Megalaspis cordyla</i> , <i>Parastromateus niger</i> , <i>Scomberoides lysan</i> , <i>Eleutheronema tetradactylum</i>	Fins, scales, gills, streamlined body	Consumers in marine food webs	Biodiversity, classification, adaptation, ecosystem
Crustaceans	<i>Penaeus monodon</i>	Segmented body, exoskeleton, jointed appendages	Detritivores and consumers	Arthropod characteristics, classification, ecosystem interactions
Mollusks	<i>Uroteuthis duvaucelii</i> , <i>Ommastrephes bartramii</i>	Soft body, mantle, tentacles	Predators and prey in marine ecosystems	Adaptation, biodiversity, ecological interactions

The identified fauna exhibit observable morphological characteristics and ecological functions that are relevant to Biology learning. Fish provide examples of vertebrate diversity and adaptation to aquatic environments, crustaceans illustrate arthropod body organization, and mollusks demonstrate structural and behavioral adaptations to marine habitats. These characteristics can be directly observed and analyzed by students during learning activities. From an educational perspective, the diversity of fauna found in fishermen's catches offers authentic biological objects that can support contextual and inquiry-based learning. Students can conduct observation, identification, classification, and ecological analysis activities using organisms that originate from their surrounding environment. Therefore, the identified fauna not only represent coastal biodiversity but also provide potential learning resources that connect biological concepts with real-world environmental contexts.

Potential Analysis as Biology Learning Resources

The analysis showed that the identified fauna possess strong potential as contextual learning resources because they represent authentic biological objects directly related to Biology concepts taught in Phase E. The diversity of species enables students to conduct observation, comparison, classification, and ecological analysis activities that are aligned with scientific inquiry processes. inquiry-based learning activities encourage active participation, scientific reasoning, and conceptual understanding among students (Nuraini et al., 2025; Winters et al., 2024). Alignment of Identified Fauna with Biology Learning Outcomes Phase E can be seen in Table 4.

Table 4. Alignment of Identified Fauna with Biology Learning Outcomes Phase E

Biology Concept	Learning Outcome Relevance	Potential Learning Activity
Biodiversity	Species diversity	Identification and classification
Classification	Taxonomic grouping	Observation worksheet
Ecosystem	Ecological roles	Food web construction
Interaction among organisms	Predator-prey relationships	Inquiry investigation

The educational value of the identified fauna is not limited to their biological characteristics but also lies in their potential to be translated into contextual learning resources. Based on curriculum analysis, the identified fauna can be developed into student worksheets (LKPD), inquiry-based observation activities, biodiversity modules, and field-study assignments that are aligned with Phase E Biology Learning Outcomes. Utilizing coastal fauna as a learning resource supported the development of science process skills, such as observing, classifying, measuring, and communicating results. Within an inquiry-based learning model, students actively participated in species identification, morphological analysis, and organism grouping according to scientific classification. This process provides opportunities for students to engage in scientific reasoning and data interpretation through direct observation of biological objects.

In addition to biodiversity material, fauna caught by fishermen were used to explain ecological concepts, such as food chains, food webs, and interactions between organisms. Students understand the roles of organisms in an ecosystem, such as producers, consumers, and decomposers. By directly connecting theory to real-world conditions at Depok Beach, learning became more meaningful and less abstract. Utilizing locally based learning resources has the potential to support the development of environmental literacy by connecting biological concepts with authentic environmental issues. By understanding the diversity and ecological role of marine fauna, students became more aware of the importance of preserving coastal ecosystems. This fostered environmental stewardship and awareness of the impacts of human activities, such as overfishing and marine pollution.

Based on these results, the fauna caught by fishermen on Depok Beach, Bantul, had ecological and economic as well as great potential as a contextual, applicable, and relevant biology learning resource. The utilization is in line with the Merdeka

Curriculum in Phase E, which emphasizes context-based learning. It has the potential to support the development of critical thinking and environmental literacy through contextual learning experiences. Therefore, integrating these local learning resources improved the quality of biology learning in a more meaningful and sustainable manner.

Analysis of the Relationship with Biology Learning Outcomes (CP) in Phase E

The use of fauna is highly relevant to the Biology learning outcomes (CP) in Phase E, specifically the concepts of biodiversity, classification of living things, as well as the structure and function of organisms. Through direct observation of fish, crustaceans, and mollusks, students grasped classification concepts more concretely, from grouping based on morphological characteristics to determining simple taxonomic levels. This helped students develop a deeper understanding than learning based solely on text or images.

Within the process skills element, coastal fauna-based learning activities enabled students to develop a range of scientific skills, including observing, identifying, classifying, analyzing data, and communicating results. Activities such as identifying species caught by fishermen and grouping based on characteristics are well-suited to the inquiry method, which requires active exploration of concepts independently. Accordingly, learning focuses not only on the final product but also on the scientific process conducted by students.

Phase E biology learning outcomes emphasized the importance of understanding the environmental context and sustainability. In this regard, using fauna caught by fishermen as learning resources provided students with opportunities to understand the relationship between living things and their environment in a concrete way. The impact of human activities, such as fishing, on the balance of marine ecosystems was analyzed. Furthermore, students are encouraged to reflect on the importance of sustainable fishing practices to maintain the sustainability of biological resources.

This local resource-based learning supported the strengthening of the Pancasila Student Profile, particularly in the dimensions of cooperation, critical reasoning, and environmental awareness. Fauna identification activities and group discussions encouraged students to work collaboratively and exchange ideas. The process of data analysis and conclusion drawing fostered critical thinking skills, while an understanding of coastal ecosystems fostered a sense of environmental stewardship. Therefore, learning is not solely oriented toward cognitive aspects but also character development.

The utilization of the diverse fauna caught by fishermen at Depok Beach, Bantul, strongly correlated with the Biology learning outcomes of Phase E in the Merdeka Curriculum. This integration enabled contextual, meaningful learning and was oriented toward developing students' holistic competencies, comprising knowledge, skills, and attitudes. Furthermore, the diversity and accessibility of these fauna provide authentic learning objects that allow students to observe biological phenomena directly, thereby facilitating the achievement of biodiversity,

classification, and ecosystem-related learning outcomes outlined in Phase E Biology.

Utilization as a Learning Resource

Fauna caught by fishermen were utilized as a contextual learning medium that brings real-world objects into the learning process. Teachers can bring samples of fish, shrimp, or squid into the classroom for direct observation. As a result, students not only visualize concepts but also visualize, touch, and identify organisms' characteristics directly. This method increased engagement and strengthened the understanding of abstract biological concepts more concretely.

Fisherman's catches were integrated into practical activities through Student Worksheets (LKPD). In the LKPD, students were guided to identify species, observe morphological structures, and group organisms by classification. These activities were structured based on an inquiry-based learning model, enabling the discovery of concepts through the scientific process actively. Furthermore, the LKPD were supplemented with analytical questions that encouraged the connection of observations to concepts of biodiversity and ecology.

The identified fauna can potentially be utilized in project-based learning (PjBL). For example, students may be assigned to develop biodiversity reports, classification posters, or educational media based on fauna observed from fishermen's catches. Students were assigned projects to compile reports on fauna diversity, create classification posters, or develop educational media, such as booklets or instructional videos. These activities not only enhanced conceptual understanding but also cultivated 21st-century skills, including creativity, collaboration, communication, and critical thinking. Local environment-based projects made learning more meaningful and relevant to students' lives.

The identified fauna also provide opportunities for future development into digital learning resources, such as augmented reality (AR), interactive videos, or mobile-based learning applications. Students accessed additional information through QR codes that connect to descriptions of species, habitats, and ecological roles. This method was highly relevant to learning needs in the digital age and improved students' digital literacy. Furthermore, technology integration facilitates a more engaging and interactive learning experience.

Field study activities at Depok Beach may serve as authentic learning experiences where students observe fishermen's catches, identify fauna diversity, and investigate ecological relationships within coastal ecosystems. Students directly observed fishermen's activities, identified the species of fauna caught, as well as understand the relationships between organisms and the environment. Fishermen were interviewed to obtain contextual information on the species caught and the fishing seasons. This hands-on field learning experience enhanced conceptual understanding while fostering environmental awareness.

The use of fauna caught by fishermen at Depok Beach, Bantul, as a learning resource was diverse and flexible, ranging from classroom learning media to field

activities and technology integration. This diversity of uses allowed teachers to develop innovative, contextual learning that was in line with the demands of the Merdeka Curriculum, thereby improving the quality of biology learning in Phase E of senior high school.

Discussion

Coastal Fauna Diversity at Depok Beach, Bantul

The coastal fauna diversity at Depok Beach, Bantul, has characteristics consistent with tropical coastal ecosystems in Indonesia, which are known for their high biodiversity, particularly among fish, crustaceans, and mollusks. The results show that the fauna diversity in fishermen's catches reflects a combination of pelagic organisms inhabiting various water zones, from the open ocean to coastal areas and estuaries. This result corresponds to a study where Indonesian coastal waters can support a variety of fish species with relatively high diversity, as suggested by diversity index values reaching the moderate to high range (Jabbar & Nurlaela, 2025).

The dominance of fish in catches at Depok Beach shows that the aquatic ecosystem south of Yogyakarta has relatively high productivity. Pelagic fish, such as tuna and snapper, generally dominate due to their high mobility and ability to live in groups, making catch easier. This is in line with results that pelagic and reef fish are often key components of coastal fauna diversity due to their adaptability to the dynamics of the marine environment (Jabbar & Nurlaela, 2025). Furthermore, the presence of fish as a key component shows the availability of sufficient food sources, such as plankton, which form the basis of the food chain in marine ecosystems.

The level of coastal fauna diversity is significantly influenced by environmental factors such as temperature, salinity, dissolved oxygen, and substrate conditions. Variations in these environmental parameters determine the distribution and abundance of each species. As reported in a study on bivalve diversity in coastal Indonesia, changes in water physical and chemical conditions can influence the diversity and dominance of certain species (Alam et al., 2025). Therefore, the environmental dynamics of Depok Beach, influenced by Indian Ocean waves and estuarine flows, contribute to the formation of a diverse fauna community.

In addition to natural environmental factors, fishing activities influence the composition of the identified fauna. The fishing gear used tends to be selective for certain species, leading to a preponderance of organisms with specific sizes and behaviors, such as pelagic fish and squid. This implies that the observed diversity in catches does not fully reflect the ecosystem but represents the fauna economically captured. The coastal fauna diversity of Depok Beach, Bantul, is moderate to high, with fish dominating and supported by crustaceans and mollusks. This reflects the productive and dynamic condition of the coastal ecosystem, influenced by interactions between biotic and abiotic factors, with human activities. The results are in line with various recent studies confirming that Indonesia's coastal ecosystems are among the areas possessing the highest biodiversity richness.

Sustainable management is required to maintain ecosystem balance and the sustainability of biological resources.

Characteristics and Ecological Role of Fauna

The coastal fauna found in fishermen's catches at Depok Beach, Bantul, consist primarily of fish, crustaceans, and mollusks. These groups exhibit diverse morphological and physiological characteristics that reflect their adaptation to dynamic marine environments. Fish generally possess streamlined bodies and gills, crustaceans are characterized by exoskeletons, while mollusks such as squid have soft bodies and high mobility in the water column. Such variations demonstrate how different organisms adapt to environmental conditions and occupy specific ecological niches within coastal ecosystems (Pörtner et al., 2022). Understanding these physiological adaptations provides relevant examples for explaining how living organisms respond to environmental changes, a concept that is closely related to biodiversity and ecology learning in secondary biology education (Pörtner et al., 2022).

Beyond their biological characteristics, the diversity of coastal fauna provides valuable learning resources for studying biodiversity, classification, adaptation, and ecological interactions. The observable differences among fauna groups enable students to identify distinguishing characteristics, compare organismal adaptations, and relate biological concepts to real-world examples. This supports contextual learning by connecting classroom content with local environmental conditions. The fauna identified also play important ecological roles within coastal ecosystems. Fish occupy different trophic levels, crustaceans contribute to nutrient cycling through detritivory, and mollusks function as predators and prey within marine food webs. These ecological relationships illustrate the interconnectedness of organisms and their environments, making them relevant examples for learning ecosystem dynamics and food-web interactions (Estes et al., 2016).

Coastal ecosystems with diverse fauna communities contribute to ecosystem stability and biodiversity conservation (Barbier et al., 2011). Understanding these ecological functions can help learners appreciate the importance of conserving biological resources and maintaining environmental sustainability. In this context, coastal fauna not only represent biological diversity but also provide authentic learning objects that can support the implementation of contextual and local potential-based biology education.

Furthermore, the presence of easily observable fauna from fishermen's catches offers opportunities for direct observation and inquiry-based learning activities. Such learning experiences are aligned with the objectives of biology education, particularly in developing scientific process skills through observation, identification, classification, and interpretation of biological phenomena. Therefore, the diversity of coastal fauna at Depok Beach, Bantul, demonstrates not only ecological significance but also considerable potential as a contextual biology learning resource.

Fauna Potential as a Biology Learning Resource

The coastal fauna diversity at Depok Beach, Bantul, has enormous potential as a contextual biology learning resource, especially at the senior high school Phase E level. Using real-world objects from surroundings can enhance learning by allowing students not only to receive theoretical information but also to experience the process of observing and identifying organisms directly. This method is in line with the principles of contextual learning, which emphasize the connection between learning materials and students' real-life situations, thereby fostering a deeper understanding of concepts (Aswita et al., 2026; Ige et al., 2025).

In the context of biology learning, fauna caught by fishermen can be used to teach various important concepts, such as biodiversity, the classification of living things, the structure and function of organisms, and interactions within ecosystems. Students directly identify fish, crustaceans, and mollusks, and compare morphological characteristics between groups. This activity supports inquiry-based learning, encouraging the discovery of concepts through the scientific process actively (Nuraini et al., 2025). Learning based on authentic environmental contexts provides meaningful opportunities for students to connect biological concepts with real-world phenomena (Yaya et al., 2025).

Utilizing coastal fauna as a learning resource contributes to the development of 21st-century skills, such as critical thinking, creativity, collaboration, and communication (Nuraini et al., 2025; Susilowati et al., 2026). Through practical activities, group discussions, and environment-based projects, students can develop analytical skills and present results scientifically. This is in line with the demands of the Merdeka Curriculum, which emphasizes competency-based learning and the strengthening of the Pancasila Student Profile.

The integration of technology in the use of learning resources further strengthens the potential of coastal fauna in biology learning. The adoption of AR-based media, interactive videos, or digital applications allows students to access information in more engaging ways. AR technology, for example, can help visualize the 3D anatomical structures of marine animals, thereby facilitating students' understanding of complex concepts. A recent study has shown that the use of digital technology in biology learning improves digital literacy and engagement in the learning process (Radianti et al., 2020). Furthermore, the adoption of coastal fauna as a learning resource is crucial for enhancing environmental literacy and conservation awareness. By understanding the diversity and ecological roles of marine organisms, students are expected to develop a caring attitude toward coastal environmental sustainability. This is crucial, as coastal ecosystems are vulnerable to damage from human activities, such as overfishing and marine pollution. Local environment-based education has been shown to foster ecological awareness and environmentally friendly behaviors among students (Ardoin et al., 2020).

Based on the above description, the coastal fauna of Depok Beach, Bantul, has strategic potential as an innovative, contextual, and relevant biology learning resource for 21st-century learning needs. This utilization not only improves

students' conceptual understanding and skills but also fosters an environmentally conscious attitude, which is an essential part of sustainable education. Therefore, integrating locally based learning resources can be an effective alternative to improve the quality of biology learning in Phase E of senior high school.

Relevance to the Merdeka Curriculum Phase E

Utilizing the coastal fauna diversity of Depok Beach, Bantul, as a learning resource is strongly relevant to the implementation of the Merdeka Curriculum, particularly in Phase E (grade 10 of senior high school). The Merdeka Curriculum emphasizes student-centered, contextual learning, as well as encourages the strengthening of competencies and character. In this case, the use of locally based learning resources enables direct learning through real-life experiences, making learning more meaningful and less theoretical (Ige et al., 2025; Kemendikbudristek, 2022). In terms of CP, the material on coastal fauna diversity is highly relevant to understanding biological concepts, particularly biodiversity, classification of living things, and ecology. Students not only grasp concepts in relation to real-world conditions in their surroundings. This is in line with the deep learning method in the Merdeka Curriculum, which emphasizes in-depth understanding and the ability to apply knowledge in everyday contexts.

The use of coastal fauna supports the development of science process skills. Through activities such as observation, identification, classification, and data analysis, students are trained to think scientifically and systematically. This method is in line with the inquiry-based learning model recommended in the Merdeka Curriculum, which encourages students to actively demand, discover, and construct self-knowledge (Nuraini et al., 2025). A study shows that the inquiry method is effective in improving critical thinking and problem-solving skills (Hmelo-Silver et al., 2007).

Another relevance is observed in the integration of PjBL, a primary method in the Merdeka Curriculum (Susilowati et al., 2026). Coastal fauna can serve as the subject of various learning projects, such as compiling biodiversity reports, creating educational media, or conducting environmental conservation campaigns. These activities not only enhance conceptual understanding but also develop 21st-century skills, such as creativity, collaboration, communication, and digital literacy. Furthermore, the use of local learning resources contributes to strengthening the Pancasila Student Profile. Through group-work learning activities, students are trained to develop a spirit of cooperation. The process of analysis and problem-solving fosters critical reasoning skills, while direct engagement with the coastal environment fosters a sense of environmental stewardship. This is in line with the objectives of the Merdeka Curriculum, which focus on cognitive aspects as well as character development and national values.

Integrating technology such as AR into coastal fauna learning supports the digital transformation in education, which is the focus of the Merdeka Curriculum. The use of this technology can increase student engagement and strengthen digital literacy, a crucial competency in the Society 5.0 era (Radianti et al., 2020). The

coastal fauna diversity of Depok Beach, Bantul, is highly relevant to the principles, objectives, and methods of the Merdeka Curriculum Phase E. The use of these learning resources can holistically integrate knowledge, skills, and attitudes, thereby creating biology learning that is more contextual, innovative, and oriented toward developing students' overall competencies.

Educational Implications of Local-Potential-Based Learning Resources

The findings support previous studies indicating that local environmental resources can serve as effective contextual learning resources in biology education (Wulandari & Djukri, 2021). Similar studies have shown that integrating local potential into learning activities helps connect scientific concepts with students' real-life experiences (Carolina et al., 2024). Learning resources derived from local environments also provide authentic learning experiences that make biological concepts more meaningful and easier for students to understand (Fajeriadi et al., 2025). Furthermore, the integration of local potential into biology learning is consistent with the objectives of the Merdeka Curriculum, which encourages the utilization of contextual and environment-based learning resources (Kemendikbudristek, 2022).

The identified fauna diversity provides opportunities for implementing inquiry-based learning because students can formulate questions, conduct observations, classify organisms, analyze ecological roles, and communicate findings (Ali et al., 2025). These activities are consistent with the scientific process emphasized in the Merdeka Curriculum (Kemendikbudristek, 2022). Inquiry-oriented learning activities have been reported to support the development of scientific reasoning and students' active participation in constructing biological knowledge (Hmelo-Silver et al., 2007). In addition, direct interaction with authentic biological objects can strengthen students' observational and analytical skills, which are essential components of science process skills (Fikriyah et al., 2024).

Furthermore, the use of local fauna resources supports contextual learning by bringing authentic environmental phenomena into the classroom. Project-based e-modules can support the development of scientific literacy and problem-solving skills (Susilowati et al., 2026). This approach can enhance students' engagement, conceptual understanding, and motivation by connecting scientific concepts with their everyday experiences (Carolina et al., 2024; Fajeriadi et al., 2025). Moreover, integrating local environmental contexts into biology learning contributes to environmental awareness and appreciation of biodiversity conservation (Ardoin et al., 2020).

Educational Contribution of the Study

This study contributes to biology education by providing empirical data on local coastal fauna that can be systematically integrated into contextual learning resources. Unlike previous biodiversity studies that primarily focused on ecological descriptions, this study establishes explicit links between identified fauna, Biology Learning Outcomes (CP) of Phase E, and potential inquiry-based learning activities.

The findings support previous studies emphasizing the importance of local-potential-based learning resources in creating meaningful and contextual learning experiences. Therefore, the identified fauna diversity may serve as a foundation for the future development and validation of teaching materials, learning modules, and student worksheets in biology education.

This study focused on the identification of fauna diversity from fishermen's catches and the analysis of its potential as a contextual Biology learning resource. The research was not designed as a research and development (R&D) study and therefore did not involve the development, expert validation, teacher assessment, student evaluation, or classroom implementation of learning materials. Consequently, the findings should be interpreted as evidence of educational potential rather than confirmed instructional feasibility. Future studies are recommended to develop learning materials based on the identified fauna and evaluate their validity, practicality, and effectiveness in Biology learning.

4. Conclusion

The fishermen's catches at Depok Beach, Bantul, consisted of diverse fish, crustacean, and mollusk species that represent the biodiversity of the coastal ecosystem. The identified fauna possess biological characteristics and ecological roles that are relevant to Biology concepts in Phase E of the Merdeka Curriculum, particularly biodiversity, classification, ecosystem dynamics, and ecological interactions. The findings indicate that the identified fauna have the potential to be utilized as contextual Biology learning resources because they are closely related to students' surrounding environment and can support observation, classification, and inquiry-based learning activities. Furthermore, the identified fauna provide a foundation for the development of learning materials such as student worksheets (LKPD), teaching modules, and field-based learning activities that integrate local coastal potential. However, since this study was limited to identification and educational potential analysis, further research involving learning-resource development, expert validation, and classroom implementation is needed to evaluate the validity, practicality, and effectiveness of such resources in Biology learning.

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