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Integrated Community-Based Conservation of Olive Ridley Sea Turtles in Response to Coastal Abrasion

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ABSTRACT
Background: Coastal abrasion and human activities have significantly degraded the nesting habitats of the olive ridley sea turtle (Lepidochelys olivacea).
Purpose of the Study: This community service program aimed to save sea turtles through conservation activities, including nest relocation, hatching, and releasing hatchlings through a community-based collaborative approach.
Methods: This community service focused on relocating olive ridley sea turtle nests threatened by coastal abrasion and developing hatching facilities. Through hatchling releases and conservation education, the program increased local community participation and promoted sustainable eco-tourism.
Results: The program successfully relocated 28 nests containing 3,005 eggs, increasing hatching success from <50% to 64.7%. Monthly hatchling releases and educational activities increased community awareness and strengthened their role in eco-based sea turtle conservation.

Keywords
Abrasion; Community; Conservation; Olive Ridley Sea; Sea Turtle

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Introduction

A coastal area in Indonesia is one of the important habitats for olive ridley turtles (*Lepidochelys olivacea*). The olive ridley sea turtle (*L. olivacea*) is one of the six species of sea turtles that inhabit Indonesian waters. It is listed as a protected (endangered) species under Government Regulation of the Minister of Environment and Forestry (Kementerian Lingkungan Hidup dan Kehutanan, 2018). Indonesia is a significant migratory and nesting corridor for this species, with a particular emphasis on the southern coastlines of Java, Bali, and Nusa Tenggara (Pike, 2013; Rumaida et al., 2021). *Lepidochelys olivacea* is distinguished by its olive-colored carapace, comparatively small size, and distinctive mass-nesting behavior, known as "arribada," although such events are uncommon in Indonesia in comparison to India or Costa Rica (Rojas-Cañizales et al., 2022; Shanker et al., 2004). The species is crucial for maintaining the balance of the marine ecosystem by contributing to the exchange of nutrients between marine and terrestrial environments (Hamann et al., 2010; Tucker et al., 1998).

In Indonesia, olive ridley turtle populations have declined in recent decades due to habitat loss, beach abrasion, artificial lighting, illicit egg collection, and plastic pollution (Mustaqim et al., 2020). Nesting frequency along the southern coast of Java has decreased by nearly 40% over the past two decades, according to data from the Ministry of Marine Affairs and Fisheries. The urgent necessity for integrated conservation actions that incorporate habitat protection, community education, and sustainable eco-tourism to ensure the survival of *L. olivacea* in Indonesia's coastal ecosystems is underscored by these pressures.

In recent years, coastal areas in Indonesia have faced ecological pressure due to coastal abrasion, illegal egg collection, and attacks from natural predators, including monitor lizards and wild birds (Irsadi et al., 2022; Pheasey et al., 2021). This condition has resulted in a significant decline in the number of turtle nests and hatching success in their natural habitat. Before the community service activity, the natural nesting site was frequently inundated by seawater, leading to egg spoilage and a hatching success rate of less than 50% in several nesting seasons. Additionally, the absence of proper hatchery facilities and structured conservation education programs among residents limited the community's capacity to engage actively in sea turtle protection efforts. In response to pressing ecological and social challenges, a collaborative initiative was formed involving universities and relevant government organizations, local stakeholders, and the regional marine and fisheries authority. This collaboration aimed to develop a community-oriented sea turtle conservation strategy through habitat relocation, hatchery development, and environmental education, grounded in the One Health framework and sustainable eco-tourism principles.

This community service aimed to rehabilitate the nesting habitat of the olive ridley turtle, strengthen local conservation capacity and integrate ecological preservation with community-oriented economic empowerment. This effort is anticipated to foster lasting social change by enhancing local understanding of biodiversity preservation and establishing sustainable tourism opportunities centered on turtle conservation. This activity advances national conservation objectives and aligns with the Sustainable Development Goals (SDGs), specifically Goal 14: Life Below Water, which emphasizes the safeguarding and sustainable use of marine and coastal habitats.

Method

This community service activity was conducted in September 2025 in a coastal area in Indonesia, focusing on the conservation of olive ridley sea turtles (*L. olivacea*), whose nesting habitats have been severely degraded by coastal erosion. The program began with socialization (sosialisasi) activities involving local government representatives, community-based tourism groups (n=45 participants) to raise awareness of sea turtle conservation and the need for

immediate habitat protection. Through participatory discussions, the community was informed about the threats faced by sea turtles, including illegal egg collection and natural predation, and the importance of sustainable conservation efforts.

Subsequent sea turtle conservation sessions were conducted with community group members and volunteers (n=30), focusing on proper egg handling, nest relocation techniques, and hatchling care. The training also included the operation of new conservation facilities supported by the Ministry of Higher Education, Science, and Technology, including one large PVC tank for adult turtle holding, eight hatching aquariums, several small PVC tanks for hatchlings, thermoregulator device and a borehole to maintain humidity for egg incubation.

In the technology application stage, these facilities were utilized to enhance hatching success and turtle care efficiency. Eggs relocated from the wild were incubated in semi-natural hatcheries with controlled temperature and humidity. Hatchlings were raised until reaching a carapace length of at least 5 cm or 2 weeks of age before release. Mentoring and evaluation were conducted regularly by universities teams through field visits, monitoring hatch success, and assessing community involvement and knowledge improvement.

Program sustainability was promoted through monthly hatchling release events, involving residents, students, and tourists. Weekly educational sessions preceding the releases covered the life cycle of turtles, threats to their survival, and the conservation of coastal ecosystems. These activities effectively increased local awareness and participation while also providing economic benefits through eco-education-based tourism. The collaborative conservation model developed through this program has strengthened community commitment to protect sea turtles and ensured the long-term preservation of *L. olivacea* populations. A flowchart of the community services activity is presented in Figure 1.

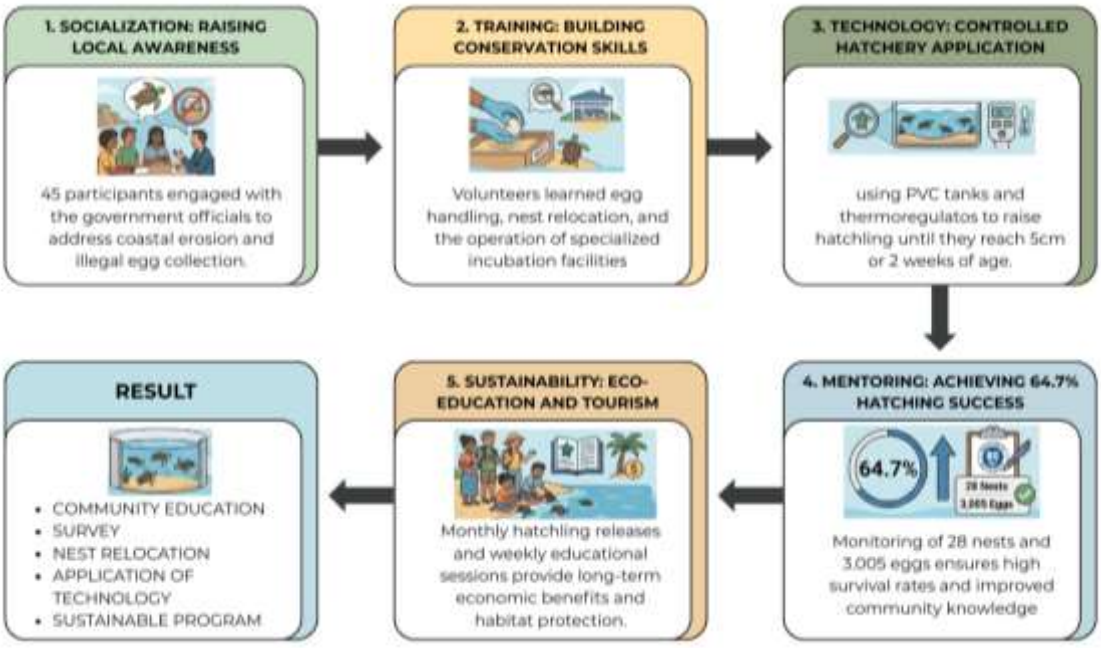

Figure 1. Flowchart of the community services activity (generated by Canva).

Result

The community service initiative is scheduled from September 2025 to January 2026 in a coastal area in Indonesia, in collaboration with universities, relevant government organizations, community groups, and local stakeholders. This endeavor encompasses habitat surveys, nest

relocation, egg hatching, hatchling care, and community education.

Socialization

The program began with a series of grassroots dialogues designed to align university objectives with local priorities. Instead of imposing external solutions, the team conducted Focus Group Discussions (FGDs) involving 45 participants, including local fishers, youth groups, and stakeholders. The aim was to map threats to turtle habitats, specifically coastal erosion, abrasion, and illegal egg collection. Rather than simply receiving instructions, the community actively proposed the Banaran Fish Auction Place as a strategic and safe location for a new nesting site. This bottom-up approach resulted in the voluntary formation of a local monitoring team of ten active members, marking the first step toward community-led conservation.

Training

To ensure the community was not merely providing labor but also acquiring technical skills, several intensive training sessions were held. Each session lasted approximately three hours and covered standardized nest identification, safe egg relocation techniques, and the operation of thermoregulatory devices—including how to connect and operate the "Penyuku" Android application to an internet connection. The response was measured both quantitatively and qualitatively. Pre- and post-training questionnaires showed an 80% increase in technical competency among volunteers. Qualitatively, participants reported a significant shift in perspective: they no longer viewed turtle eggs as a commodity but as an essential part of their coastal heritage that required active protection.

Technology

This stage marked the transition from learning to doing, as the community took charge of constructing and installing conservation facilities. Together with the project team, local residents installed a large PVC tank for adult sea turtle confinement, six aquariums, five small PVC tanks for hatchling accommodation, a thermoregulatory device, and a drilled well to maintain sand moisture at the semi-natural nesting site. Community participation was evident through the establishment of a self-managed monitoring system. Local volunteers checked the thermoregulatory devices and sand conditions daily using the controlled hatchery Android application, ensuring a stable environment for four relocated nests—one device serving all four nests.

Mentoring

Continuous mentoring throughout the incubation period led to tangible improvements in hatching outcomes. Monitoring data revealed 28 natural nests of the olive ridley turtle (Lepidochelys olivacea), containing a total of 3,005 eggs. Of these, 1,946 eggs successfully hatched, while 1,059 did not. This yielded a hatching success rate of 64.7%, a significant increase from the pre-intervention level of less than 50%. Importantly, this success was not solely due to the technology provided, but also to the rapid, community-led response in relocating nests endangered by coastal erosion.

Monitoring data collected from 28 natural nests of the olive ridley turtle (*Lepidochelys olivacea*) are summarized in the table below.

Table 1. Hatching Success of Lepidochelys olivacea Nests Before and After Intervention

Parameter	Number / Percentage
Total natural nests (L. olivacea)	28
Total eggs	3,005
Eggs successfully hatched	1,946
Eggs that did not hatch	1,059
Hatching success rate (post-intervention)	64.7%
Pre-intervention hatching rate (baseline)	< 50%

The increase from below 50% to 64.7% represents a significant improvement. Importantly, this success was not solely due to the technology provided, but also to the rapid, community-led response in relocating nests endangered by coastal erosion.

Sustainability

The final stage focused on embedding the program into the local social fabric to ensure long-term viability and support for eco-education and tourism. The team facilitated 12 weekly educational sessions, each with an average attendance rate of over 80%. These sessions prepared the community to lead monthly hatchling release events. The program culminated in the release of 100 hatchlings, involving 45 participants including students and tourists. Looking ahead, the community has begun drafting a management plan for a community-based ecotourism model. This signifies a complete transition from external mentoring to independent, bottom-up management, ensuring the program's sustainability for years to come.

The sea turtle hatchling release event (Figure 2) occurs monthly and engages the community, schools, and tourists. Before release, participants received weekly instruction on the life cycle, biology, and dangers to sea turtles, along with the significance of conservation in maintaining the balance of the marine ecosystem.

Figure 2. The sea turtle hatchling release event

Discussion

The community service program in a coastal area in Indonesia has led to a notable increase in the hatching success rate of *L. olivacea* eggs, primarily due to the relocation of nests and improvements in breeding facilities. Prior to the intervention, numerous natural nests were compromised due to significant coastal erosion and elevated tidal flooding, resulting in increased

egg mortality and reduced hatching success. Relocating 28 nests with 3,005 eggs to a safer area and enhancing sand humidity via borehole installation improved the nesting environment for embryo development, increasing hatching success from <50% to 64.7%. The results align with earlier research indicating that regulated incubation conditions, characterized by optimal humidity and temperature, can markedly improve hatchling success in sea turtles (Rosalina & Prihajatno, 2022; Segura & Cajade, 2010; Tolen et al., 2021).

Weekly educational activities conducted prior to hatchling release events have effectively increased local awareness and encouraged behavioral changes toward turtle conservation from a community development perspective. This is consistent with the participatory conservation model outlined by Abalo-Morla et al., 2018; Dharini, 2008; Godfrey & Drif, 2001), in which community-based learning and tourism-oriented conservation initiatives enhance the sustainability of endangered species protection. The incorporation of environmental education alongside practical activities, including hatchling release and nest monitoring, enhances the socio-ecological relationship between local communities and marine ecosystems (Costa et al., 2023; Quesada-Rodríguez et al., 2021). This engagement promotes collective responsibility and enhances long-term stewardship of coastal biodiversity.

Collaboration among universities, governmental institutions, and local stakeholders, was crucial to the program's success. The provision of PVC tanks for adult turtle conservation, along with smaller PVC tanks and aquariums for hatchling maintenance, has significantly improved the quality of the hatchery system. These facilities mitigate hatchling mortality caused by predators and environmental stressors, thereby increasing survival rates and improving long-term conservation outcomes. The active participation of students contributed to technical implementation and facilitated knowledge transfer, fostering a new generation of conservation advocates within the community.

This program demonstrates the integration of ecological conservation and socio-economic development through multi-stakeholder collaboration, adhering to the principles of One Health and sustainable eco-tourism. The increase in hatchling success and public awareness demonstrates significant ecological and social impacts that correspond with the objectives stated in the introduction. The program outcomes align with the Sustainable Development Goals (SDGs), specifically Goal 14: Life Below Water, which focuses on the protection of marine ecosystems and the sustainable utilization of coastal resources. Future activities must prioritize the long-term monitoring of nesting frequency, hatchling survival rates, and the formulation of community-based policies to safeguard nesting beaches from illegal egg collection and habitat degradation.

Despite the positive results, some limitations should be emphasized. First, the duration of the program was quite brief (about 4–5 months), which may not have reflected long-term ecological implications or seasonal fluctuations in nesting activity. Second, the program was only conducted in a single coastal site, which may restrict the generalizability of the findings to other places with varying environmental and socio-cultural variables. Third, the program lacked long-term monitoring of released hatchlings, making it impossible to determine post-release survival rates and their contribution to population recovery. Finally, the long-term viability of conservation outcomes may depend on continued community participation, institutional support, and resource availability after the program is completed. Future projects should include long-term ecological monitoring, multi-site implementation, and strengthened community-based management mechanism to ensure sustained conservation impact.

Conclusion

The community service program in a coastal area in Indonesia successfully demonstrated that collaborative conservation efforts can enhance the hatching success of olive ridley turtles (*Lepidochelys olivacea*) through nest relocation, habitat restoration, and the establishment of suitable conservation facilities. The program successfully relocated 28 nests containing 3,005 eggs, increasing hatching success from <50% to 64.7%. Weekly educational programs and hatchling release events strengthened community awareness and participation, establishing a sustainable model that integrates biodiversity protection with eco-education-based tourism. This initiative not only safeguards a protected species but also supports local livelihoods, serving as a replicable model for coastal conservation aligned with Sustainable Development Goal 14 (Life Below Water).

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Conflicts of Interest

The authors declare that they have no conflict of interest.

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