

# Sustainability strategy for turtle conservation in Kelapa Dua Island, Kepulauan Seribu District, Jakarta, Indonesia

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**Abstract.** Gulo GS, Tumuyu SS, Patria MP. 2024. Sustainability strategy for turtle conservation in Kelapa Dua Island, Kepulauan Seribu District, Jakarta, Indonesia. *Biodiversitas* 25: 2307-2314. The background of this research stems from the excessive exploitation and shift from subsistence to commercial use that has caused a decline in turtle populations. Therefore, it is necessary to safeguard turtle populations within Indonesia's distinct marine habitats, particularly at SPTN (National Park Management) I, Kelapa Dua Island, Kepulauan Seribu, Jakarta, Indonesia. Addressing the challenges in turtle conservation, this study systematically collected data through expert interviews, providing in-depth insights into the conservation landscape. The research methodology includes data collection via expert interviews and subsequent analysis using the Strengths, Weaknesses, Opportunities, and Threats (SWOT) method, providing a strategic framework to enhance conservation outcomes. The results highlight the critical need for habitat protection, stakeholder involvement, and rigorous law enforcement. Based on the four alternative strategies that have been prepared, the S-T strategy approach has the highest score, namely 4, making it a priority strategy for sustainable turtle conservation on Kelapa Dua Island. The following strategic priorities are W-O strategy, S-O strategy and W-T strategy. This study's conclusion shows suitable strategies for research problems, such as advocacy for habitat protection, active stakeholder involvement, and strict law enforcement to ensure the effectiveness and sustainability of conservation initiatives.

**Keywords:** Conservation, island, sea turtle sustainable, SWOT

## INTRODUCTION

Indonesia is an archipelagic country with over 17,500 islands and a coastline stretching over 81,000 km, providing ample nesting areas for turtles (Supriatna and Margules 2022). In Indonesia, there are six turtle species which are *Chelonia mydas* Linnaeus 1758, *Dermochelys coriacea* Vandelli 1761, *Eretmochelys imbricata* 1766, *Caretta caretta* Linnaeus 1758, *Lepidochelys olivacea* Eschscholtz 1829, and *Natator depressus* Garman 1880, these species play crucial roles in the ecosystem, such as controlling the seagrass population (Rodriguez and Heck 2020), nutrient cycle for coastal ecosystems (Lovich et al. 2018) and serving as macroherbivores in coral reefs (Cardona et al. 2020). Additionally, turtles play a significant role in supporting the economic needs of coastal communities in Indonesia (Hamed et al. 2016). The utilization of turtles has been practiced by local communities for thousands of years (Mejías-Balsalobre et al. 2021). However, excessive exploitation and shifting from subsistence to commercial use have caused a decline in turtle populations (Ingram et al. 2022). Unsustainable and illegal resource exploitation threatens these communities' socio-ecological systems (Lopes et al. 2022).

Internationally, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973 designated turtles in Appendix I, indicating that international commercial trade in turtles is prohibited (Saladin 2021). In 1982, the International Union for

Conservation of Nature (IUCN) listed turtles on the red list of endangered species (Sas-Rolfes et al. 2019; Sahri et al. 2020). In line with these determinations, the Indonesian government issued Government Regulation of The Republic of Indonesia No. 7/1999 on Preserving Flora and Fauna Species, which states that turtles are included in the list of protected animals by the state (Sadili et al. 2015; Fahmi and Rizki 2022), this is also in line with Minister of Maritime Affairs and Fisheries Decree Number 65 of 2022 which states the national action plan for sea turtle conservation. The regulations and determinations made have prompted global conservation efforts to prevent the extinction of turtles and their habitats and to prevent the exploitation of turtles for specific purposes (Rees et al. 2016).

Indonesia has several turtle conservation areas designated under the Ministry of Environment and Forestry, including the Kepulauan Seribu National Park (TNKpS) (Supriatna and Margules 2022). This conservation area was established based on the Minister of Forestry Number 6310/Kpts-II/2002 Decree and divided into three National Park Management Sections (SPTNs). Each SPTN manages one turtle conservation site, one of which is located in the SPTN I area of Kelapa Dua Island (Balai Taman Nasional Kepulauan Seribu 2022). Management in TNKpS is divided into three SPTN regions. The SPTN Region I office is located on Kelapa Dua Island, SPTN Region II on Harapan Island, and SPTN Region III on Pramuka Island. According to the Minister of

Environment and Forestry Regulation No. P.7/Menlhk/Setjen/OTL.0/1/2016 concerning the Organization and Work Procedures of National Park Technical Implementation Units. SPTN Region I on Kelapa Island, covering an area of 39,932 hectares or approximately 37.15% of the Seribu Islands National Park area, has two Core Zones: Gosong Rengat Island and Karang Rengat Island. Conservation activities include saving turtle eggs and rearing and releasing hatchlings (Indrajaya et al. 2018; Sosiawan and Setia 2023).

In addition to increasing the protection and survival opportunities of sea turtles in the wild, the existence of sea turtle conservation sites can support education (Casimiro et al. 2023), research (OkurBerberoglu et al. 2014), and the economy through tourism (Hunt and Vargas 2018), making their sustainability very important. The sustainability of turtle conservation sites can be measured in three aspects, namely environmental, social, and economic aspects (Virto 2018; Mendes et al. 2019). Based on previous research, the hatching success in SPTN I TNKpS is only 71.59%, indicating that the management of semi-natural turtle hatcheries still needs to be improved (Sosiawan and Setia 2023). This could be due to the poor condition of the turtle eggs found or other external factors, such as suboptimal temperature and pH levels in artificial nests (São Miguel et al. 2022), shaking, and changes in egg position during the relocation process (Warkentin et al. 2022). Development activities in coastal areas for tourism can threaten sea turtle nesting habitat (Oliver de la Esperanza et al. 2017). Socio-economic benefits are also an important factor in the sustainability of turtle conservation.

This study aims to formulate appropriate strategies to support the sustainability of sea turtle conservation in the SPTN I Kelapa Dua Island Region, Kepulauan Seribu National Park, based on expert assessment using the SWOT method.

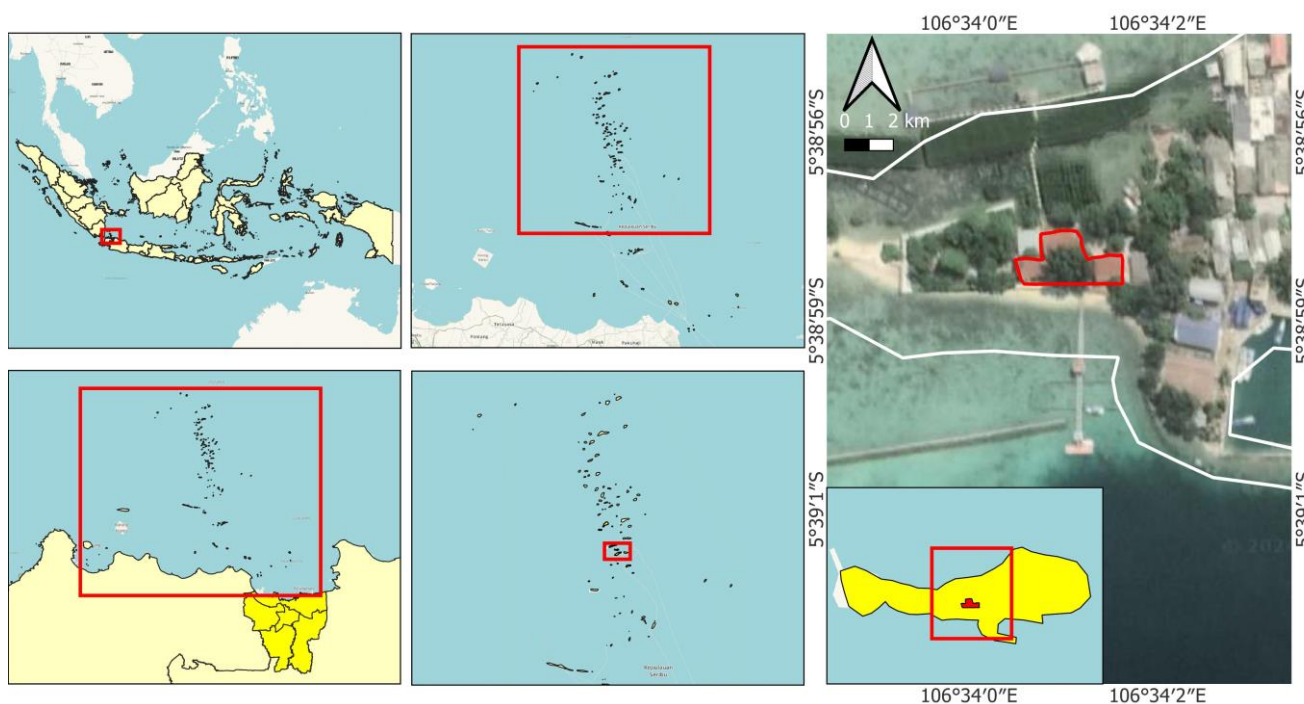
## MATERIALS AND METHODS

### Study area

The research was conducted in the Kepulauan Seribu National Park, which is administratively located in the Kepulauan Seribu Utara Sub-district, Kepulauan Seribu Administrative District, Jakarta Province, Indonesia (Figure 1). Geographically, the Kepulauan Seribu National Park is located at 5024'-5045' S and 106025'-106040' E. The southern outer boundary of the area is  $\pm 50$  km from the mainland of Jakarta. The area in this study is focused on the SPTN I area, Kepulauan Seribu National Park. The turtle conservation area is located in Kelapa Dua Island. This island has an area of 1.90 hectares intended for residential areas, fish farms, and SPTN Region I offices.

### Data collection

This research uses quantitative methods. The data used includes primary data and secondary data. Secondary data were obtained from data from the Kepulauan Seribu National Park, a review of related documents, journals, statistical data, and related scientific research. Primary data were obtained directly from field observations and by filling out expert questionnaires.



**Figure 1.** Study location in turtle conservation area, Kelapa Dua Island, Kepulauan Seribu Utara Sub-district, Kepulauan Seribu Administrative District, Jakarta, Indonesia

Expert sampling was conducted using a convenience sampling technique. Experts involved as respondents in the research are academics in the field of conservation and representatives of NGOs working in the field of sea turtle conservation. The experts as informants were selected based on the criteria of having at least two years of experience working in the field of turtle conservation and having conducted research on sea turtles, as evidenced by their publications. The experts selected consisted of two SPTN workers as government representatives, two people from an NGO, and an academic from the university. Furthermore, the data obtained will be analyzed by reducing, presenting, and then drawing conclusions.

### Data analysis

Data analysis was carried out using SWOT analysis, which aims to identify internal and external factors of a business and develop a strategic plan to minimize the impact of weaknesses and threats by strengthening the benefits of strengths and opportunities.

SWOT analysis begins with determining internal factors (IFAS), which include strengths and weaknesses, and external factors (EFAS), which include opportunities and threats, obtained from data collection. Next, the weight of each factor was determined through the completion of a questionnaire by experts selected according to the criteria. In the weighting process, the importance level of each factor was assessed using criteria from 1-4 (very unimportant to develop-very important to develop) in accordance with the criteria in the study by Ma'ruf (2022).

After the weight was determined, each factor was assessed or ranked. The rating score was calculated by averaging each weight using Microsoft Excel software. The ranking results are based on the extent of each factor's influence on turtle conservation activities. The rating scores range from 1-4 (very negligible to very influential). The weight and rating values were multiplied to obtain a total score and tabulated in a matrix.

The turtle conservation sustainability strategy is formulated in 4 (four) strategy frameworks, namely SO (strength-opportunity), WO (weakness-opportunity), ST (strength-threat), and WT (weakness-threat). The strategy framework is plotted in the SWOT analysis quadrant. Determination of the coordinate value is done using the scoring calculation results.

## RESULTS AND DISCUSSION

### Identification of Internal and External Strategy Factors

The SWOT analysis focuses on internal and external environmental factors that directly influence the sustainability of sea turtle conservation in Kelapa Dua Island. The analysis results will be the basis for determining alternative strategies for the sustainability of sea turtle conservation in Kelapa Dua Island.

Internal factors (IFAS) are internal factors that influence turtle conservation activities, consisting of Strengths and Weaknesses. Strengths are the strengths or

advantages of the turtle conservation site in Kelapa Dua Island. Weaknesses are negative factors that can reduce the performance of turtle conservation in Kelapa Dua Island. The results of identifying internal strategic factors can be seen in Table 1.

Based on the IFAS matrix, four strength factors have the same weight, namely the nest monitoring factor carried out six times a year, the security factor of the conservation site, conservation activities carried out by the available SOPs, and the existence of legal regulations as the basis for turtle conservation in Kelapa Dua Island. These four factors received a total score of 0.29. The strength factor with the lowest weight is hatchling care and rearing facilities. This factor received the lowest weight because some experts needed to be trained in the head-starting conservation technique practiced in Kelapa Dua Island. The weakness factor with the highest total score was incomplete data archiving, with a score of 0.29. The weakness factors with the lowest total score are the absence of turtle egg-hatching tanks and the fact that funding mostly only comes from the government. The total score obtained in the IFAS matrix is 3.55, which indicates that the strategies applied at the Kelapa Dua Island turtle conservation site can respond to various factors in their internal environment.

External factors affecting turtle conservation activities in Kelapa Dua Island are referred to as external factors (EFAS) and consist of Opportunities and Threats. Opportunities are considered opportunities for the development of sea turtle conservation in Kelapa Dua Island. Conversely, Threats are factors that jeopardize or threaten turtle conservation activities in Kelapa Dua Island. The results of identifying external strategic factors can be seen in Table 2.

Referring to the EFAS matrix, the highest strategic opportunity factor score is the existence of public awareness and government support for sea turtle conservation. These two factors obtained the same total score of 0.47. The lowest opportunity value is the location factor around conservation sites with tourist attractions and donor support in certain events. These two factors received the same total score of 0.17. The biggest challenge in managing sea turtle conservation in Kelapa Dua Island is the community's illegal utilization of sea turtles, which has a score of 0.47. The threat factor with the lowest score is the location of the nesting island, which is far from the conservation site. The total score on the EFAS matrix is 3.52, indicating that the turtle conservation site in Kelapa Dua Island can respond to various factors in its external environment.

### Formulation strategy for the sustainability of turtle conservation in Kelapa Dua

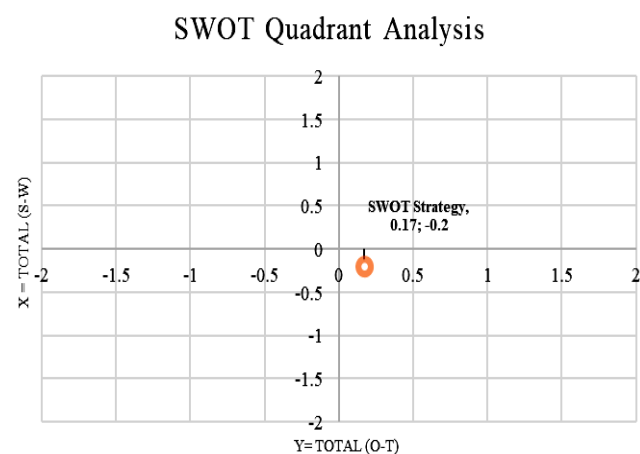
Alternative strategies are formulated by bringing together internal and external factors to produce several alternative strategies consisting of 4 strategies, namely S-O (Strength-Opportunity) strategy, W-O (Weakness-Opportunity) strategy, ST (Strength-Threat) and W-T (Weakness-Threat). Alternative strategies can be seen in Table 3.

**Table 1.** Internal factors identification

Internal factors (IFAS)	Weight	Rating	Total
<b>Strengths</b>			
Monitoring of sea turtle nests is routinely carried out 6x a year.	0.07	4.00	0.29
Hatchling care and rearing facilities available	0.05	2.60	0.12
The location of the conservation site is safe.	0.07	4.00	0.29
Hatchling food is readily available	0.05	2.80	0.14
Flow conditions of turtle-rearing ponds are good.	0.06	3.40	0.21
Conservation activities follow existing SOPs.	0.07	4.00	0.29
Regular availability of funds from the government every year.	0.07	3.20	0.22
Some laws underpin sea turtle conservation.	0.07	4.00	0.29
<b>Total</b>			<b>1.86</b>
<b>Weaknesses</b>			
The hatching rate is less than 80%	0.07	3.80	0.27
The turtle conservation area does not have a turtle egg hatchery.	0.05	2.80	0.14
Lack of cooperation with organizations or NGOs related to sea turtle conservation.	0.06	3.20	0.19
Conservation funding is mostly only from the government.	0.05	2.80	0.14
Internal conflict	0.07	3.60	0.24
Lack of guides and information boards that can provide education about sea turtles to tourists	0.07	3.60	0.24
Sea turtle educational tourism provides little benefit to the local community.	0.06	3.20	0.19
Data archiving is incomplete.	0.07	4.00	0.29
<b>Total</b>			<b>1.69</b>
<b>Total Score IFAS</b>			<b>3.55</b>

**Table 2.** External factors identification

External factors (EFAS)	Weight	Rating	Total
<b>Opportunities</b>			
There is government support.	0.12	4.00	0.47
The location around the conservation site is a tourist attraction.	0.07	2.40	0.17
Community awareness.	0.12	4.00	0.47
Culture/community beliefs	0.11	3.60	0.38
Donor support for specific events	0.07	2.40	0.17
<b>Total</b>			<b>1.66</b>
<b>Threats</b>			
Turtles are easily stressed due to the many tourists entering the conservation area.	0.11	3.80	0.43
Environmental changes due to construction	0.11	3.60	0.38
The presence of predators	0.11	3.60	0.38
Illegal utilization of sea turtles by the community	0.12	4.00	0.47
The location of the nesting island is far from the conservation site.	0.08	2.60	0.20
<b>Total</b>			<b>1.86</b>
<b>Total Score EFAS</b>			<b>3.52</b>

**Figure 2.** SWOT quadrant analysis

### Determination of turtle conservation strategy

Based on the weighting results, it can be observed that the total score of strengths is greater than the total score of weaknesses on internal factors, and the total score of opportunities is smaller than the total score of threats on external factors. Therefore, based on the calculation of coordinate values, the sustainability strategy for turtle conservation in Kelapa Dua Island is located at the coordinate point (0.17; -0.2) as per the following quadrant analysis in Figure 2. The order of strategic priorities can be seen in the following Table 4.

### Discussion

Based on the SWOT analysis, Kelapa Dua Island's turtle conservation development strategy is situated in the second quadrant through a diversification strategy. This strategy is formulated by leveraging existing strengths to address threats. Subsequent strategies are developed in

priority order, following the W-O, S-O, and W-T strategies. The strategies formulated based on that analysis are as follows.

### Building hatcheries on nesting islands

The hatchery on Pulau Kelapa Dua was not built directly on the nesting island. Turtle eggs are relocated from nesting islands that are quite far from the conservation site. This long distance has the potential to decrease the hatching success rate due to the extended relocation time (Phillott et al. 2021) and the vibrations produced during the relocation process (Nasiri et al. 2023).

According to the Conservation Management Guidelines for Sea Turtle Conservation in Southeast Asia (Ali et al. 2004), this strategy can be an effective solution to enhance the hatching success of turtle eggs, particularly if the government focuses on the conservation aspect of sea turtles. From an ecological perspective, the effectiveness of turtle hatching on nesting islands can be attributed to several key factors. Nesting islands often provide ideal conditions for turtle nests, including appropriate temperature, humidity, and sand composition, which are crucial for the development and hatching success of turtle eggs.

**Table 3.** SWOT analysis matrix of turtle conservation sustainability in Kelapa Dua Island, Kepulauan Seribu District, Jakarta, Indonesia

		Strengths	Weaknesses
		S1. Monitoring of sea turtle nests is routinely carried out 6x a year S2. Hatchling care and rearing facilities available S3. The location of the conservation site is safe. S4. Hatchling food is readily available S5. Flow conditions of turtle-rearing ponds are good S6. Conservation activities follow existing SOPs S7. Regular availability of funds from the government every year. S8. Some laws underpin sea turtle conservation	W1. The hatching rate is less than 80% W2. The turtle conservation area does not have a turtle egg hatchery. W3. Lack of cooperation with organizations or NGOs related to sea turtle conservation. W4. Conservation funding is mostly only from the government. W5. Internal Conflict W6. Lack of guides and information boards that can provide education about sea turtles to tourists W7. Sea turtle educational tourism provides little benefit to the local community. W8. Data archiving is incomplete.
Opportunities	S-O	W-O	
O1. There is government support. O2. The location around the conservation site is a tourist attraction. O3. Community awareness. O4. Culture/community beliefs O5. Donor support for specific events	1. Increase the number of turtle conservation areas (S2, S3, S4, S5, S6, S7, S8, O1, O2, O3, O4) 2. Increase the budget for monitoring activities so that they can be carried out every month. (S1, O5)	1. Providing hatching facilities to help optimize the hatching of turtle eggs (W1, W2, O1) 2. Increase collaboration with NGOs to obtain philanthropic funding (W3, W4, O2, O5) 3. Provide training to local communities so they can be involved as guides in educational turtle tourism (W6, O3) 4. Collaborate with the local government to provide a place for the community to sell tourist services (W7, O1) 5. Resolve conflicts by continuing to involve stakeholders in turtle conservation efforts (W8, O1)	
Threats	S-T	W-T	
T1. Turtles are easily stressed due to the many tourists entering the conservation area T2. Environmental changes due to construction T3. The presence of predators T4. Illegal utilization of sea turtles by the community T5. The location of the nesting island is far from the conservation site	1. Build semi-natural hatcheries directly on nesting islands or islands adjacent to turtle nesting islands (S7, T3, T5) 2. Do not keep newly hatched hatchlings or adult turtles in conservation areas except in particular conditions, such as turtles that are injured or sick as a result of being netted by fishermen (by-catch turtles) (S2, S3, S4, S5, S6, T1) 3. Increase supervision and provide strict sanctions to people who use turtles illegally (S1, S8, T4) 4. Carry out development planning by considering the turtle range and migration areas (S3, T2).	1. Building collaboration with NGOs to increase public awareness about the importance of turtle conservation through education and involvement in turtle conservation activities (W3, W7, T4) 2. Integrate environmentally based tourism development with the surrounding community (W6, T1) 3. Conduct more research and data collection as a basis for structuring coastal areas to support turtle conservation (W8, T2)	

**Table 4.** Strategic priorities for turtle conservation sustainability in Kelapa Dua Island, Kepulauan Seribu District, Jakarta, Indonesia

Alternative strategy	Linkage	Score	Total score	Ranking
<b>S-O Strategy</b>				
Increase the number of turtle conservation areas	S2, S3, S4, S5, S6, S7, S8, O1, O2, O3, O4	2.924	3.384	3
Increase the budget for monitoring activities so that they can be carried out every month	S1, O5	0.46		
<b>W-O Strategy</b>				
Providing hatching facilities to help optimize the hatching of turtle eggs	W1, W2, O1	0.88	3.71	2
Increase collaboration with NGOs to obtain philanthropic funding	W3, W4, O2, O5	0.7		
Provide training to local communities so they can be involved as guides in educational turtle tourism	W6, O3	0.71		
Collaborate with the local government to provide a place for the community to sell tourist services	W7, O1	0.66		
Resolve conflicts by continuing to involve stakeholders in turtle conservation efforts	W8, O1	0.76		
<b>S-T Strategy</b>				
Build semi-natural hatcheries directly on nesting islands or islands adjacent to turtle nesting islands	S7, T3, T5	0.8	4	1
Do not keep newly hatched hatchlings or adult turtles in conservation areas except in particular conditions, such as turtles that are injured or sick as a result of being netted by fishermen (by-catch turtles)	S2, S3, S4, S5, S6, T1	1.48		
Increase supervision and provide strict sanctions to people who use turtles illegally	S1, S8, T4	1.05		
Carry out development planning by considering the turtle range and migration areas	S3, T2	0.67		
<b>W-T Strategy</b>				
Building collaboration with NGOs to increase public awareness about the importance of turtle conservation through education and involvement in turtle conservation activities	W3, W7, T4	0.85	2.19	4
Integrate environmentally based tourism development with the surrounding community	W6, T1	0.67		
Conduct more research and data collection as a basis for structuring coastal areas to support turtle conservation	W8, T2	0.67		

Establishing hatcheries in controlled environments can significantly reduce the risk of predation on turtle eggs and hatchlings, as this controlled setting allows for better monitoring and management of potential threats from predators. Nests are constructed in the supratidal zone, which is located above the highest tidal zone and generally remains unaffected by seawater except during extremely high tides (Ali et al. 2004; Dermawan et al. 2009).

Apart from the advantage of shorter relocation distances and transportation, this strategy can also effectively raise public awareness. Involving the community in conservation activities becomes feasible as this strategy requires more human resources for intensive supervision, hatchery maintenance, and monitoring eggs and hatchlings for potential predator threats (Phillott and Shanker 2018). However, implementing this strategy might pose challenges if the government aims to integrate conservation activities with ecotourism since many nesting islands fall within core zones that restrict tourist activities (Charles Darwin Foundation 2024). Therefore, an alternative strategy could involve establishing turtle conservation

centers on nearby islands that are not part of the core zones if the government intends to integrate turtle conservation with ecotourism.

#### **Not maintaining hatchlings and adult turtles in conservation areas**

This strategy is good to be developed to avoid disrupting the natural behavior patterns of turtles in their natural habitat. The maintenance of newly hatched hatchlings or adult turtles in conservation areas can be reserved for special conditions, such as injured and sick turtles caught by fishermen (by-catch turtles). This strategy allows turtle educational tourism without showcasing live turtles, as implemented at the Mon Repos Turtle Center in Queensland. Education can be provided through video or film presentations, the creation of replica eggs and turtles to study their life cycle and species, and exhibitions or interactive theatres about turtles and conservation (Fajri 2021; Frame et al. 2021). This education can serve as a tourist attraction and educate visitors without disturbing the turtle life cycle. According to research by Trave et al.

(2017), turtle conservation activities at the Mon Repos Conservation Park in Queensland have successfully protected and supported the turtle population. Based on previous discussions, ecotourism practices, particularly turtle-watching programs, have positively impacted turtle conservation. This strategy can also reduce the cost of turtle maintenance since only turtles requiring specific care are kept before being released back into the sea. Boa Vista is another location that could be a model for implementing turtle ecotourism. Turtle ecotourism contributes to the sustainable economic development of coastal communities without disrupting turtle nesting activities (Marco et al. 2021).

### Improving surveillance and imposing sanctions

Enhancing surveillance and imposing strict sanctions on the community is a strategy that can be developed to reduce the illegal exploitation of turtles (Pheasey et al. 2021; Lopes et al. 2022). The frequency of illegal turtle exploitation in Kelapa Dua Island is currently decreasing. However, surveillance and sanctions can be balanced by continuously educating the community about the importance of turtle conservation and the rules and legal sanctions that can be imposed if the community engages in illegal turtle exploitation. This explanation is in line with the research by Busaidi et al. (2019), stating that conservation education through tourism can increase awareness of the sustainability of turtle resources. The government should also strive to involve the community more in turtle conservation activities or educational turtle tourism, as exploration is needed to understand the urgency of community involvement in these efforts. Engaging the local population is crucial for fostering a sense of ownership and responsibility towards conservation initiatives, ensuring long-term success and sustainability. This way, the community can experience the benefits of the conservation efforts because healthy turtle populations can positively impact fishery resources by supporting balanced marine ecosystems that are vital for the life cycles of commercially important fish species.

### Coastal development planning

One of the biggest threats to the sustainability of turtle conservation in SPTN I TNKpS is tourism development, considering the increasing number of tourists every year. In line with the growing tourism development, stakeholders must intervene to ensure the turtle life cycle is not disrupted (Rousso and Sanchez 2015). A strategy that can be developed is to plan development by considering the range and migration of turtles. Referring to the guidelines for managing sea turtle protection areas from several researches, some actions that the government can take include establishing a minimum distance between new buildings and the beach, reducing lighting in turtle conservation areas, limiting or controlling human presence on the beach at night during the turtle nesting season, and restricting ship travel in protected areas (Demetropoulos 2009; Marangoni et al. 2022; Jägerbrand and Bouroussis 2021; Long et al. 2022).

In conclusion, this research evaluates turtle conservation at SPTN I Kelapa Dua Island, identifying its strengths and challenges. The study finds more internal strengths but higher external threats, advising a strategic focus on using strengths to counter threats. Key recommendations include protecting habitats, involving stakeholders, and enforcing laws to ensure that conservation efforts are effective and sustainable. Protecting habitats involves government agencies and conservation organizations implementing and enforcing strict regulations to safeguard turtle nesting sites and marine ecosystems from development and pollution. This includes establishing protected areas and minimizing human disturbances. Involving stakeholders requires government agencies and conservation organizations to actively engage local communities, tourism operators, and NGOs in conservation activities through education, training, and collaborative projects, fostering a sense of ownership and support for conservation efforts. Finally, enforcing laws involves law enforcement agencies and government regulators strengthening the enforcement of existing conservation laws and regulations by increasing surveillance, conducting regular inspections, and imposing penalties for violations to ensure compliance and deter harmful activities.

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