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Turtle Biology Conservation at Taman Kili Kili Beach, Wonocoyo Village

Juliaeta AB Mamesah[1*], Maureen A Tuapattinaja[1], J. M. S Tetelepta[1], Mintje Wawo[1], Fadila Salma[2]

[1] Teaching Staff for Water Resources Management Department, Universitas Pattimura, Ambon, Indonesia.
[2] Water Resources Management Department Student, Universitas Pattimura, Ambon, Indonesia.

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Corresponding Author:
Juliaeta AB Mamesah
jellymamesah@gmail.com

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Abstract: Conservation is one of the activities that is expected to prevent the extinction of turtles and turtle habitats, preventing the use of turtles for commercial purposes such as selling their eggs, meat, and shells. This research was carried out in the Taman Kili Kili Beach area from January to March 2022. This research aimed to determine the management carried out at Taman Kili Kili Beach and the sustainability of turtle conservation at Taman Kili Kili Beach. The data analysis in this research is an initial analysis consisting of qualitative and quantitative analysis, while further analysis is a Rapfish analysis. The results of the research show that the management of turtles in the Kili-Kili Park Turtle Conservation area carries out several activities: Searching for turtle eggs, breeding process, hatchling rearing process, and releasing hatchlings into the sea. Sustainability based on the results of Rapfish for Conservation at Taman Kili Kili Beach is categorized as sustainable, but more attention needs to be paid to the institutional and infrastructure dimensions.

Keywords: Conservation; Rapfish; Turtles

Introduction

Indonesian sea waters are the habitat of six types of turtles out of the seven types that exist in the world, namely the green turtle (*Chelonia mydas*), the Olive Ridley Turtle (*Lepidochelys olivacea*), the Loggerhead Turtle (*Caretta caretta*), the Hawksbill Turtle (*Eretmochelys imbricata*), the Leatherback Turtle (*Dermochelys coriacea*), and Flatback Turtle (*Natator Depressus*). Turtle populations have experienced a decline in population over the last period and some species are even threatened with extinction. In nature, newly hatched turtles face the threat of death from animals such as crabs, birds, and other reptiles such as monitor lizards. The biggest threat to turtles in Indonesia, as throughout the world, is humans (Stanford et al., 2020). Excessive development of coastal areas has reduced turtle nesting habitat. Catching turtles for their eggs, meat, skin, and shells has reduced the turtle population (Valverde et al., 2017). Since ancient times, turtles have been a source of pride for humans. Both the meat and eggs have a delicious taste and therefore have become commodities that are exported in frozen or canned form as ingredients for making turtle soup, "calipees", and others. Sea turtles are a group of reptiles that live in the sea and can migrate long distances throughout the Indian Ocean, Pacific Ocean, and Southeast Asia (Wilmé et al., 2016). Its existence has long been threatened, both in nature and by human activities that endanger its population directly or indirectly.

Conservation is one of the activities that is expected to prevent the extinction of turtles and turtle habitats, preventing the use of turtles for commercial purposes such as selling eggs, meat, and shells (Laksmidewi, 2022). Conservation can be a means of sharing knowledge or education with the wider community about the importance of turtle conservation to protect turtle habitats in Indonesia so that they do not become extinct (Komarudin, 2023). Land shifts that cause damage to coastal habitats and feeding areas, death of

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turtles due to fishing activities, inadequate management of conservation techniques, climate change, disease, taking of turtles and their eggs, and the threat of predators are factors causing the decline in turtle populations (Fuentes et al., 2023).

Apart from that, the characteristic life cycle of turtles is very long. Reaching a "stable" condition (constant population abundance) can take quite a long time, around 30-40 years, so preserving this rare animal should be an urgent matter. This condition is what causes all types of turtles in Indonesia to be given protected status by the State as stated in PP No. 7 Number 1999 concerning the Preservation of Protected Types of Plants and Animals. Taman Kili Kili Beach is a long beach between Pelang Beach and Konang Beach and is one of the leading tourist attractions in Trenggalek Regency. This beach is a landing and nesting place for turtles. The turtles that usually land and lay eggs on this beach are Olive Ridley Turtles. Taman Kili-Kili Beach was designated as an Essential Economic Area (KEE) in 2020 to preserve the ecosystem of this area, especially saving turtles (Antriyandarti, 2023; Darmawan et al., 2020).

Turtle tourism activities are provided by the management of Taman Kili Kili Beach, namely media about turtles, releasing hatchlings, and viewing turtle care activities. The turtle that lands and lays its eggs on Taman Kili Kili Beach is the Olive Ridley Turtle. This causes Taman Kili Kili Beach to become one of the areas that has high and productive potential for sea turtles, but this fact will be directly proportional to the high level of turtle utilization in various sectors. Turtle conservation has an impact on turtle tourism activities which are directed at ecotourism, but its implementation has not been carried out optimally. Turtle conservation activities have not shown satisfactory results. Facts show that there has been a decline in the population and the number of turtle egg nests has decreased from year to year at Taman Kili Kili Beach. To realize the sustainability of the Taman Kili Kili Beach area as a turtle conservation area which can have a positive effect on improving the welfare of communities near and around the conservation area, it is necessary to analyze the potential of tourist attractions in the Taman Kili Kili Beach Turtle Conservation Area and determine its sustainability status. management of the Kili Kili Beach Turtle Conservation Area for ecotourism development.

Method

This research was carried out in January – March 2022 at Taman Kili Kili Beach, Wonocoyo Village, Panggul District, Trenggalek Regency, East Java Province.

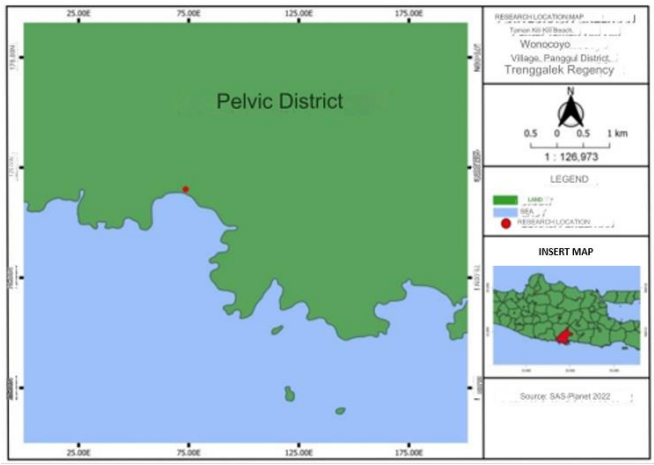

Figure 1. Research location

Tools and Materials

The tools and materials used and their use in the research process can be seen in Table 1.

Table 1. Tools and Materials

Tools and Materials	Utility
GPS	To determine field coordinates
Stationery	To record research data
Flashlight	For lighting at night
Bucket	To lay eggs that will be transferred to a semi-natural nest
Camera	For documentation in the field
Questionnaire	For the question and answers process (data collection)
Storage tank	A place to care for turtles

Method of Collecting Data

This research data was obtained from the turtle conservation management area at Taman Kili Kili Beach, Wonocoyo Village, Panggul District, Trenggalek Regency. Analysis of the effectiveness of turtle conservation is seen from management activities and indicators of the effectiveness of the activities carried out. Indicators of the effectiveness of turtle conservation activities are seen based on several activities, namely beach monitoring, turtle nesting process, hatching success, rearing facilities, the release of hatchlings (location and time), turtle rearing and visitor activities: General Conditions of the Research Location, General location conditions include regional location and geographical location, Conservation Potential of Taman Kili Kili Beach, The potential of Kili Kili Park beach is carried out by direct observation in the conservation area, and to see the potential of the turtle species being conserved. Perceptions of managers and members of the Taman Kili Kili Beach community groups regarding turtle conservation were collected through interviews and distributing questionnaires

Data Analysis Method

Turtle Conservation Sustainability Analysis

To determine the sustainability status of turtle conservation in Wonocoyo Village, a sustainability analysis was carried out on five dimensions including ecology, social, institutional, ethical, and infrastructure using the Rapfish analysis approach, then confirmed with a Monte Carlo test, then to determine the most influential attributes as leverage, a Leverage analysis was carried out. The attributes used in sustainability analysis refer to attribute standards (Almaqtari et al., 2024; Skard et al., 2021). Rapfish (Rapid Appraisal for Fisheries) is an analytical method for evaluating the sustainability of fisheries in a multidisciplinary manner based on ordination techniques (placing things in order of measured attributes) with multidimensional scaling (MDS) (Chaliluddin et al., 2023). MDS itself is a statistical technique that tries to transform multidimensionality into lower dimensions (Peterfreund et al., 2021).

The sustainability scale is determined based on the percentage of sustainability with a value range between 0% (bad) to 100% (good). The sustainability category is determined according to Jimenez et al. (2021), Petza et al. (2023), and El Bilali et al. (2021), for fisheries resource management using an environmental systems approach with the following sustainability scale classification: A percentage value < 30% is in the non-sustainable category, percentage values > 30% < 60% are in the less sustainable category, A percentage value > 60 < 70% is in the fairly sustainable category with requirements for improvements in the environmental systems approach, A percentage value > 70% is in the continuing category.

Result and Discussion

Description of Research Location

Wonocoyo Village is one of the villages under the government of Panggul District, Trenggalek Regency. Wonocoyo village is 54 kilometers southwest of the capital Trenggalek. Panggul District has an area of 678,941 Ha consisting of 370,941 Ha of plains and 308,000 Ha of hills. The height of the area from the sea ranges from 0-11 m. To the south, it borders the Indonesian Ocean with beaches stretching from west to east in the Wonocoyo Village area. This stretch of beach became known as Taman Kili-Kili Beach Based on administrative data from Wonocoyo Village, the boundaries of Wonocoyo Village are as follows (Ismail et al., 2023): North: Ngrencak Village, East: Nglebeng Village, West: Banjar Village, South: Indian Ocean. Taman Kili Kili Beach has an area of 54.4 H which directly borders the Indian Ocean on the south side, in the east there is the Gedangan River and in the north, it borders rice fields and community ponds and in the west, it borders on production forests. Administratively, Taman Kili Kili Beach is in Wonocoyo Village, Panggul District. Taman Kili Kili Beach has a sloping beach topography and generally a sandy bottom substrate.

History of the Turtle Conservation Establishment

Taman Kili-Kili Beach is one of the beaches in Wonocoyo Village, this beach has a sandy soil texture and has high hot temperatures which is the reason local people rarely visit Taman Kili-Kili Beach. Only at night do some fishermen fish there. Usually, at night people can find female turtles laying eggs on Taman Kili-Kili Beach, and then people catch the mother turtles and turtle eggs to sell and consume. Due to the lack of awareness and understanding among the public that turtles are protected animals, what the community often does when they encounter sea turtles laying eggs is to take their eggs to sell or consume themselves, therefore on May 21 2011 the Wonocoyo Village Government together with the BPD (Badan Regional Deliberation) carries out outreach and outreach to the public that sea turtles in Indonesia are protected (Jani et al., 2020).

The outreach carried out by the Wonocoyo Village government was then followed up with the drafting of a Village Regulation (Perdes). This village regulation (Village Regulation) concerns turtle conservation and also the formation of a Community Monitoring Group (POKMASWAS) for Turtle Conservation at Taman Kili Kili Beach, Wonocoyo Village. This activity was carried out after community leaders and village officials attended a turtle conservation workshop held by the East Java Provincial Maritime Affairs and Fisheries Service which took place at the Hayam Wuruk Trenggalek Hotel for two days on 18-19 May 2011. Taman Kili Kili Beach, Wonocoyo Village, is known as a beach, which has the potential as a turtle nesting place.

Turtle Conservation Planning

The task of the community service group at Taman Kili Kili Beach is to carry out turtle conservation at Taman Kili Kili Beach and the surrounding ecosystem to maintain the survival of turtles under applicable laws and regulations. Meanwhile, the annual work plan (RKT) at Taman Kili Kili Beach is:

Monitoring Program

Monitoring needs to be carried out in areas where the conservation program has been deemed successful. So, natural problems that have been resolved still need to be controlled, both internal regulations, policies, and management (Young et al., 2020). Monitoring also functions to control if new problems are discovered and changes are found in conservation areas. Apart from control, the monitoring program also includes security and supervision activities (Kaur et al., 2023). This activity is responsible for the security and preservation

of nature, especially from human influence (Mishra et al., 2021; Prasad Bhatt, 2023).

Community Outreach

The Community Outreach Program is a program where the community is invited to participate directly in turtle conservation efforts. First, the public is introduced to sea turtles and their importance. The public is invited to protect and preserve turtles.

Conservation Funds and Adoption Programs

This program can be used to develop conservation at Taman Kili Kili Beach. Conservation funds are voluntary funds provided by tourists who care about turtle conservation efforts. The program implemented by the Adopts program, tourists to adopt turtles. However, adopted turtles are not meant to be taken home. Tourists are responsible for releasing adopted turtles back into the sea.

Kili Kili Park Beach Turtle Conservation

Based on the results of interviews with Pokmaswas officers in January 2022, the Olive Ridley turtle is a type of turtle that is often found in the Taman Kili-Kili Beach area. Olive Ridley Turtles usually climb to the beach to lay their eggs. Taman Kili-Kili Beach is a suitable place for laying eggs for Olive Ridley turtles because Taman Kili-Kili Beach has fine sand which is suitable for nesting habitat for Olive Ridley turtles. Turtle conservation efforts in the Kili-Kili Park Turtle Conservation area include several activities, including Searching for turtle eggs, breeding process, hatchling rearing process, and releasing hatchlings into the sea.

Turtle Egg Search

The process of searching for eggs is carried out by patrol. Patrol activities are carried out in the morning and evening by walking along the beach from the east to the west end of Taman Kili Kili Beach. Usually, officers get 4-9 turtle nests, each containing approximately 100 turtle eggs. In the process of searching for turtle eggs, several tools are used such as flashlights and buckets. Flashlights are used for lighting during night patrols and buckets are used to lay eggs which will be moved from natural egg nests (beaches) to semi-natural egg nests (sandbox). The officers will wait until the turtles have finished laying their eggs, around 2 hours. After the mother turtle has finished laying her eggs, the mother will return to the sea and leave her eggs in the sand. (Figure 2) Officers will take the eggs and transfer them to the breeding area. Data for 2021 from January to July, officers have obtained 5812 turtle eggs.

Figure 2. Turtle nest

Breeding Process

After the eggs are taken from the nesting location, the eggs will be placed in a breeding place or semi-natural nest location that has been prepared (Figure 3). Turtle eggs will hatch after approximately 50 days. From taking the turtle eggs, placing them in the breeding tank must be under the actual conditions in nature (in the sand).

Figure 3. Semi-natural nest

Hatchling Rearing Process

After approximately 50 days, the turtle eggs will hatch into hatchlings. However, it is often found that all eggs do not hatch, some also fail to hatch. The eggs that hatch into hatchlings are then picked up and transferred by officers into prepared containers. Then the hatchlings will be moved to the hatchling rearing area in a tank filled with water. When filling water, if the hatchlings are still small, the water used in the tub should not be too high, and vice versa. The tub used must be spacious. Water changes are carried out at least twice a day depending on the amount of leftover food and turtle droppings. After the eggs hatch into hatchlings (Figure 4), they need 1 or 2 days to feed them. Feeding the hatchlings is done twice a day depending on the number of hatchlings. The types of food consumed by hatchlings are usually fish and chicory. This type of food must be made from natural ingredients. If it is made from chemicals it will kill turtles. Next, it is necessary to change the water as often as possible to avoid disease in

the hatchlings. The ideal temperature for hatchling development is around 34-35 °C. The hatchlings will be kept until they are approximately 1-3 months old and ready to be released back into the sea.

Figure 4. Hatchlings

Release of Hatchlings in the Sea

The release of hatchlings in question is the release of hatchlings into the sea resulting from rearing carried out in captivity. The release aims to increase the sea turtle population. The hatchlings are released by officers and tourists. Hatchlings that are ready to be released are approximately 1-3 months old. The hatchlings are released during the day when it is high tide (Bennett et al., 2017; Wilson et al., 2023). If there are hatchlings that walk slowly or don't move at all, the hatchlings are taken and nursed back until they move actively. Hatchlings that move slowly are caused by the hatchling reservoir being too small and not suitable for the number of hatchlings. However, not all the hatchlings were released. Pokmaswas officers will release some of the hatchlings that have successfully hatched and leave some of the hatchlings for conservation.

Figure 5. Hatchling release action
(Source: Mutaqqin Adhar/detikcom 2016)

The sustainability status of the Kili Kili Park coastal turtle conservation area was carried out using Rapfish analysis using six dimensions, namely the ecological dimension, social dimension, institutional dimension, ethical dimension, and infrastructure dimension (Bakri et al., 2023). From each dimension, several attributes are measured (quantitative and qualitative), and then weighted using Multidimensional Scaling (MDS) and analyzed using Rapfish software. Apart from that, the scoring for each dimension is adjusted to the real conditions of turtle conservation activities at Taman Kili Kili Beach.

Ecological Dimensions

In this dimension, it is a reflection of the good and bad quality of the environment and can describe from an ecological point of view the conservation area being analyzed (Hoffmann, 2022). The attributes that are estimated to influence the level of sustainability in the ecological dimension consist of six attributes, namely: The number of turtles found, the lower the number of turtles that come to lay their eggs at Taman Kili Kili Beach, the smaller the threat to conservation sustainability, Diversity. Turtles, from the types of turtles, analyzed that show ecosystem function, the risk for the sustainability of turtle conservation at Taman Kili Kili Beach is indirectly smaller.

The number of hatchlings released, the smaller the number of turtles released, the risk for the sustainability of turtle conservation is also smaller, Environmental quality, the higher the environmental care for the ecosystem in turtle conservation at Taman Kili Kili Beach, the better the sustainability of turtle conservation, Visitors, the number of visitors is one of the determining factors for the sustainability of turtle conservation, Migration Range, the more turtles that migrate, the greater. There are many opportunities for turtles to stop by to lay their eggs at Kili Kili Beach, which makes conservation sustainability even better, Waste, good waste management, and conservation sustainability are getting higher. Of the eight attributes, based on Rapfish's analysis, we can see the ecological and ecosystem factors (attributes) at the turtle conservation site at Taman Kili Kili Beach which can strengthen or hinder the biological sustainability of the Turtle Conservation.

Based on the results of the Rapfish ordination which was strengthened by Monte Carlo analysis, the sustainability status index value for the ecological dimension of turtle conservation showed a value of 88.15% (Figure 6) on a sustainability scale of 100%. These conditions explain that the level of ecological sustainability of Turtle Conservation on Kili Kili Beach is categorized as sustainable as a result of analysis with Rapfish. This situation means that the quality of the natural environment is still good and can sustainably

support every activity at the Taman Kili Kili Beach turtle conservation area.

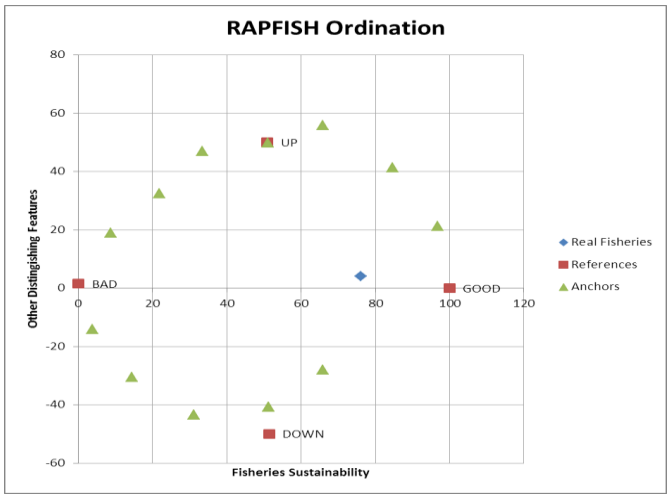

Figure 6. Status of sustainability of ecological dimensions

The stress value to measure the level of analytical determination (goodness of fit) is 0.1371 and the square correlation coefficient (R^2) is 0.9514. The stress value of the ecological dimension shows the results of the provisions (<0.25), the smaller than 0.25 the better. Meanwhile, the correlation coefficient value for this dimension is quite high (close to 1). Thus, these two statistical parameters show that the attributes used in the ecological dimension are good enough to explain the sustainability status of Turtle Conservation. Monte Carlo analysis was carried out to see the validity and stability of the Rapfish ordination process. Scatter plots that tend to cluster show the stability of the coordination process. The results of the Monte Carlo simulation analysis show that the scatter diagram for Turtle Conservation has results that tend to converge at one point (Figure 7).

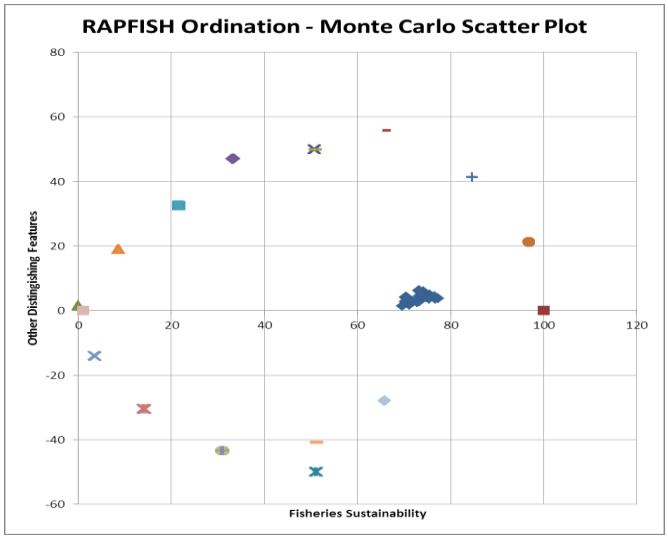

Figure 7. Positions of ecological dimensions of sustainability

Social Dimension

In this dimension, it is a reflection of how the human social system occurs and how turtle conservation takes place in the long term and in a sustainable manner. Attributes that are estimated to influence the level of sustainability in the social dimension consist of five attributes, namely: Level of education, the higher the average education of the community, the greater the tendency to increase community awareness of the sustainability of turtle conservation; Knowledge about turtles, if public knowledge about turtles is low then the risk of sustainability of turtle conservation will be lower; Level of conflict, the lower the level of conflict in society, the higher the sustainability of turtle conservation; Visitors, directly or indirectly if the number of visitors increases, will be good for the sustainability of turtle conservation; The role of the community in sustainability, community understanding in environmental conservation indirectly indicates the level of community concern for the sustainability of turtle conservation.

Based on the results of the Rapfish analysis which was strengthened by Monte Carlo analysis, the value of the sustainability status index for the social dimension of turtle conservation showed a value of 71.56% on a sustainability scale of 100% (Figure 8). These conditions explain that the level of social sustainability of Turtle Conservation at Taman Kili Kili Beach is categorized as sustainable as a result of analysis with Rapfish.

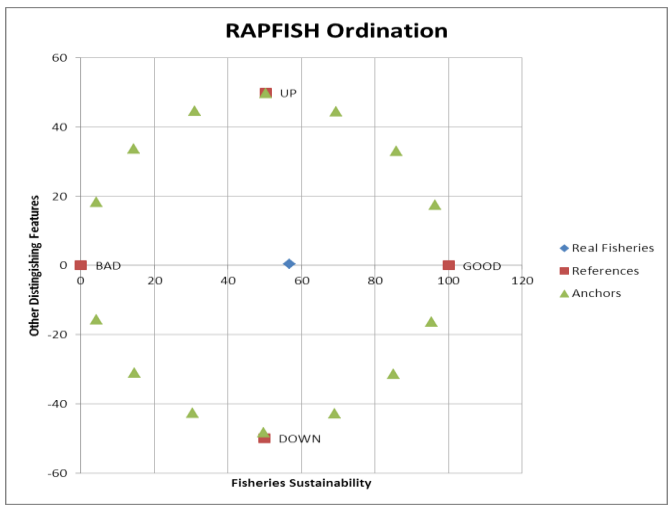

Figure 8. Social dimension sustainability status

The stress value to measure the level of accuracy of analysis (goodness of fit) is 0.13 and the square correlation coefficient (R^2) is 0.94. The stress value from the social dimension shows results that are smaller than the provisions (<0.25), the smaller than 0.25 the better. Meanwhile, the correlation coefficient value for this dimension is quite high (close to 1). Thus, these two statistical parameters show that the attributes used in the

social dimension are good enough to explain the sustainable status of turtle conservation. Monte Carlo analysis was carried out to see the validity and stability of the Rapfish ordination process. Scatter plots that tend to cluster show the stability of the coordination process. The results of the Monte Carlo simulation analysis show that the scatter diagram for the social dimension has results that tend to converge at one point (Figure 9).

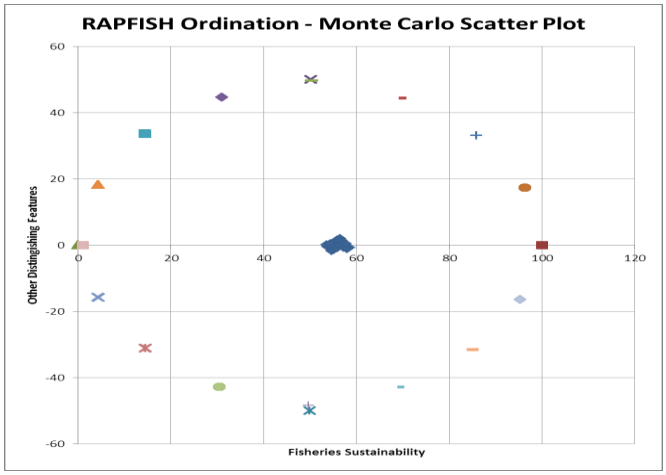

Figure 9. Position of social dimension sustainability

Institutional Dimensions

This dimension is a reflection of the degree of institutions that can support the sustainability of the turtle conservation area at Taman Kili Kili Beach. The attributes that are estimated to influence the level of sustainability in the institutional dimension consist of five attributes, namely Legality if the level of violators is lower and sanctions are in effect, the sustainability of turtle conservation will be better; Regulations, existing rules in turtle conservation areas greatly influences the sustainability of conservation; Reporting, if reporting of turtles stopping by is higher, it will be structured and sustainability will be higher; Monitoring, if carried out regularly then turtle conservation will be more sustainable; Legal Aspects, aspects The law provides negative and positive things for the sustainability of turtle conservation. The institutional dimension of sustainability in sustainability analysis predicts the influence of factors in the institutional dimension that have a positive or negative impact on the sustainability of turtle conservation.

Based on the results of the Rapfish analysis, it was found that the sustainability index value of the institutional dimension was 51.13% (Figure 10). This shows that the level of sustainability of turtle conservation at Taman Kili Kili Beach, especially the institutional dimension, is categorized as less sustainable. This illustrates that turtle conservation activities at Taman Kili Kili Beach when viewed from the institutional dimension, show a fairly high level of sustainability vulnerability in turtle conservation management. To get a better sustainability index value, it is necessary to improve the attributes that influence the index value.

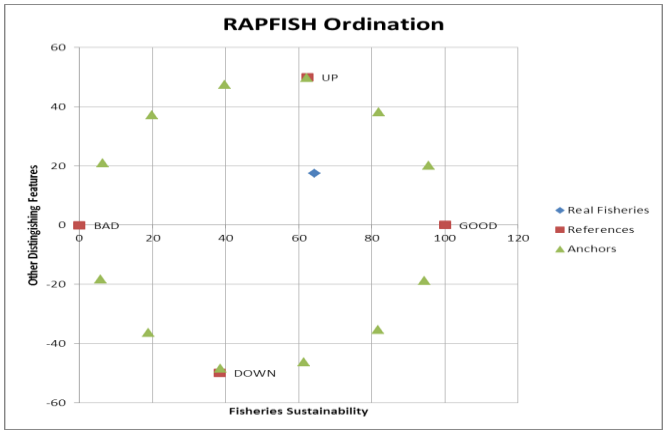

Figure 10. Sustainability status of institutional dimensions

The stress value to measure the level of accuracy of analysis (goodness of fit) is 0.1429 and the square correlation coefficient (R^2) is 0.9409. The stress value of the institutional dimension shows results that are smaller than the provisions (<0.25), the smaller than 0.25 the better. Meanwhile, the correlation coefficient value for this dimension is quite high (close to 1). Thus, these two statistical parameters show that the attributes used in the institutional dimension are good enough to explain the sustainable status of turtle conservation. Monte Carlo analysis was carried out to see the validity and stability of the Rapfish ordination process. Scatter plots that tend to cluster show the stability of the coordination process. The results of the Monte Carlo simulation analysis show that the scatter diagram for the institutional dimension has results that tend to converge at one point (Figure 11).

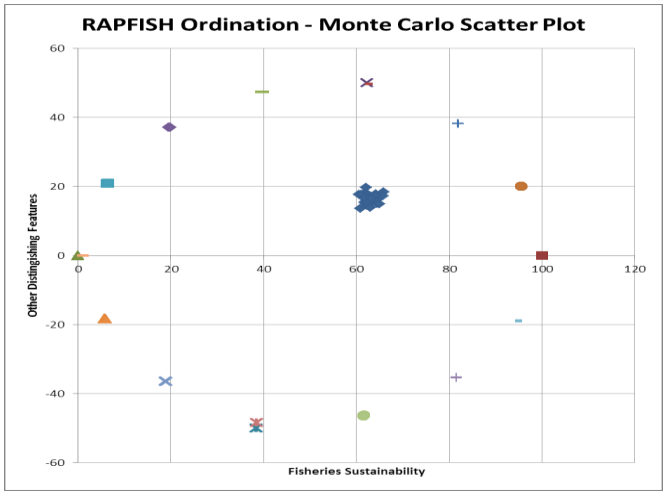

Figure 11. Institutional dimension sustainability positions

Ethical Dimensions

Analysis of the sustainability of the ethical dimensions of turtle conservation at Taman Kili Kili Beach was carried out using five attributes, namely: Legislation, the more regulations regarding the use of turtles, the higher the sustainability of turtle conservation; Level of Violations, the lower the violations, the higher the sustainability of conservation; Externalities (waste), the more environmental damage, the lower the sustainability of conservation; Customary rules and local wisdom, Illegal catching, the lower the illegal catching of turtles, the more turtles will be maintained and turtle conservation will be sustainable.

Based on the results of Rapfish processing, the sustainability index value for the ethical dimension was 60.1% (Figure 12). This shows that the level of sustainability of the management of the turtle landing area at Taman Kili Kili Beach, especially the ethical dimension, is categorized as quite sustainable. The sustainability status value of the ethical dimension means that turtle conservation activities provide fairly good performance for turtles, thereby providing benefits to the turtle conservation process. For this reason, providing education about the prohibition of illegal fishing to the community must be maintained as it is now so that turtle conservation at Taman Kili Kili Beach can be sustainable in the future.

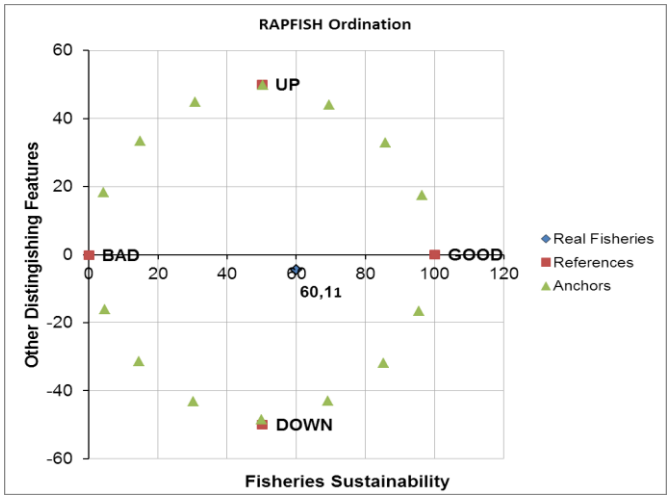

Figure 12. Ethical dimension sustainability status

The stress value to measure the level of accuracy of analysis (goodness of fit) is 0.1396 and the square correlation coefficient (R^2) is 0.9477. The stress value of the ethical dimension shows results that are smaller than the provisions (<0.25), the smaller than 0.25 the better. Meanwhile, the correlation coefficient value for this dimension is quite high (close to 1). Thus, these two statistical parameters show that the attributes used in the ethical dimension are good enough to explain the sustainable status of turtle conservation (Bennett et al., 2017; Girard et al., 2022). Monte Carlo analysis was carried out to see the validity and stability of the Rapfish ordination process. Scatter plots that tend to cluster show the stability of the coordination process (Mashur et al., 2022). The results of the Monte Carlo simulation analysis show that the scatter diagram for the ethical dimension has results that tend to converge at one point (Figure 13).

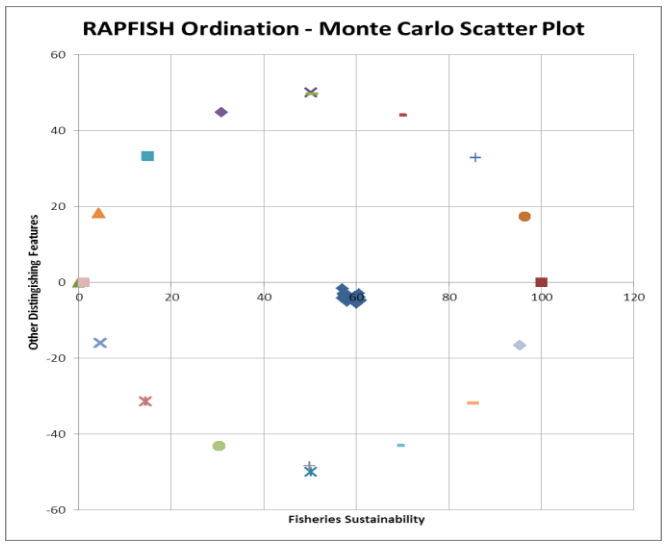

Figure 13. Ethical dimension sustainability positions

Infrastructure Dimensions

Sustainable analysis of the sustainability infrastructure dimensions of Kili Kili Beach Turtle Conservation is carried out on five attributes, namely: Road access, the impact of whether or not good road access to the turtle conservation area will have an impact on the high/low level of conservation sustainability, Infrastructure, the more infrastructure increases, the higher the sustainability of turtle conservation, Nesting facilities if the nesting places are adequate, the more eggs are accommodated and the greater the percentage of hatchlings, the higher the level of sustainability of conservation. Public transportation. The more public transportation, the higher the sustainability of turtle conservation (Kim et al., 2020; Virgili et al., 2024). Kili Kili Park Beach, Release of Hatchlings, if the hatchlings are released Involving the community will result in more positive things and this will increase the sustainability of turtle conservation. Based on the results of Rapfish processing, it was found that the sustainability index value of the infrastructure dimension was 59.68% (Figure 14). This shows that the level of sustainability of turtle conservation on Kili Kili Beach, especially the infrastructure dimension, is categorized as less than sustainable.

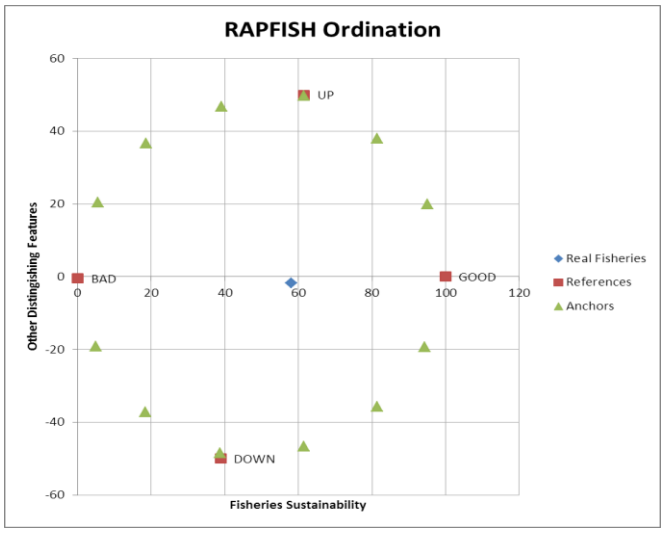

Figure 14. Sustainability results of infrastructure dimensions

The stress value to measure the level of accuracy of analysis (goodness of fit) is 0.1411 and the square correlation coefficient (R^2) is 0.9442. The stress value of the infrastructure dimension shows results that are smaller than the provisions (<0.25), the smaller than 0.25 the better. Meanwhile, the correlation coefficient value for this dimension is quite high (close to 1). Thus, these two statistical parameters show that the attributes used in the infrastructure dimension are good enough to explain the sustainable status of turtle conservation (Dupuis-Desormeaux et al., 2022; Kamaludin et al., 2023). Monte Carlo analysis was carried out to see the validity and stability of the Rapfish ordination process. Scatter plots that tend to cluster show the stability of the coordination process. The results of the Monte Carlo simulation analysis show that the scatter diagram for infrastructure dimensions has results that tend to converge at one point (Figure 15).

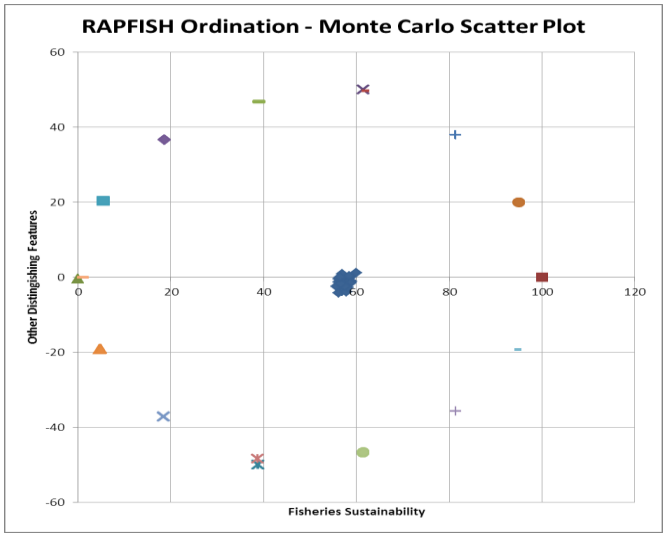

Figure 15. Infrastructure dimension sustainability positions

Sensitivity Level Analysis

Based on the description of the sustainability status of turtle conservation at Taman Kili Kili Beach, the sensitive attributes of each dimension used are grouped. Sensitive attributes obtained from each dimension used are grouped. Sensitive attributes are obtained from the results of Leverage analysis in the Rapfish method. Leverage analysis is assessed based on the standard error of the difference between the scores obtained and the attributes (Suardi et al., 2022). The leverage analysis aims to evaluate the sensitivity of each attribute to the value of establishing a turtle conservation sustainability index. Barrios-Garrido et al. (2019), and Joshi et al. (2021), explain that variables or attributes in each dimension can hinder (worse) the level of sustainability or help (increase) the level of ecological sustainability of turtle resources.

The Rapfish method allows us to assess the level of sensitivity of the attributes used (Ario et al., 2021; Patawari et al., 2022; Sutisna et al., 2020). Attribute sensitivity can be seen from how much influence or dominance an attribute has over other attributes in one dimension being studied, based on the standard error (%) value obtained. The results of the Leverage (sensitivity) analysis show that the migration range attribute (7.8) has a greater influence on sustainability from an ecological perspective compared to several other attributes (Figure 16). Migration range has a very high RMS value compared to other attributes, turtle migration aims to find food and lay eggs. This sensitivity condition illustrates that Taman Kili Kili Beach has a warm beach and is far from crowds (Pratama et al., 2020). This makes turtles comfortable when nesting and turtle breeding will increase, thus affecting the sustainability of turtle conservation at Taman Kili Kili Beach (Agustini et al., 2023).

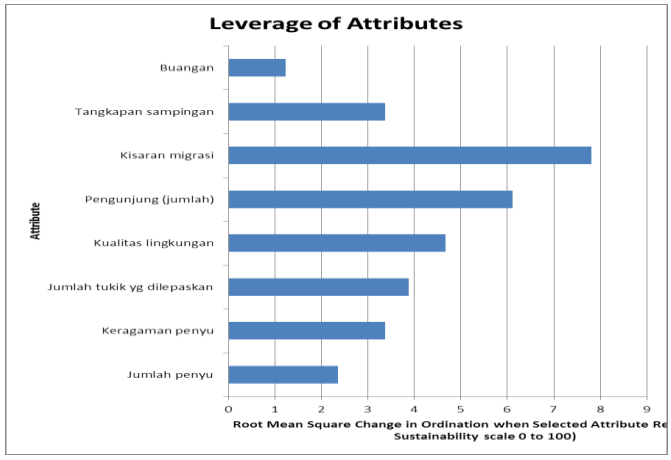

Figure 16. Leverage of ecological dimensions

From the social dimension, the attribute of the visitor's region of origin (5.69) influences the formation

of the sustainability score from a social perspective (Figure 17). Having a very high RMS value compared to other attributes, this sensitivity condition illustrates that the visitor's area of origin influences the sustainability of turtle conservation because the farther the visitor's origin means that Taman Kili Kili Beach has a good promotion known to people from various regions.

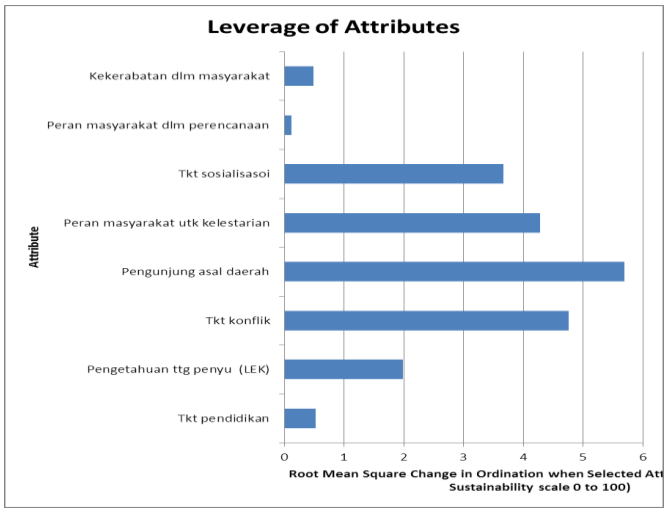

Figure 17. Social dimension leverage

The leverage results show that there are institutional dimension attributes that are sensitive or very influential on the sustainability of turtle conservation management at Taman Kili Kili Beach, namely: law enforcement has a high RMS value (7.8) compared to other attributes (Figure 18). This sensitive condition illustrates that there is a need for a legal response or policy based on sanctions to discipline people who still commit violations at Taman Kili Kili Beach.

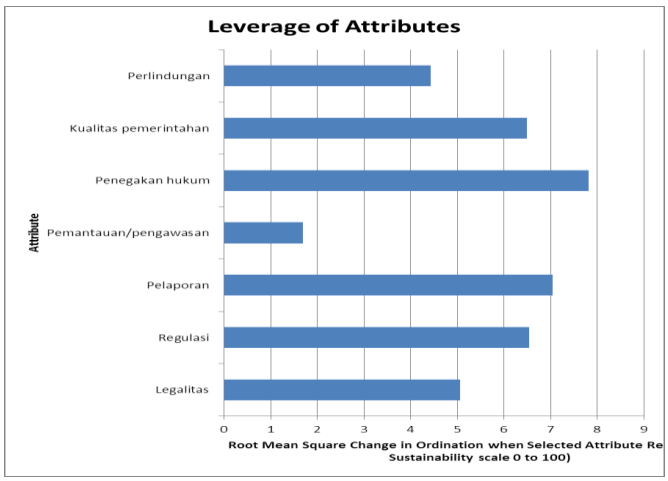

Figure 18. Leverage of institutional dimensions

For the ethical dimension, the attributes of customs and local wisdom (6.2) have quite an influence on the sustainability score for the attributes of customary rules and local wisdom which are the most influential or most sensitive attributes when compared to other attributes (Figure 19). This attribute has the highest score, which shows that the government's efforts to reduce the use of turtle resources have been good by providing fines for people who still use turtles illegally.

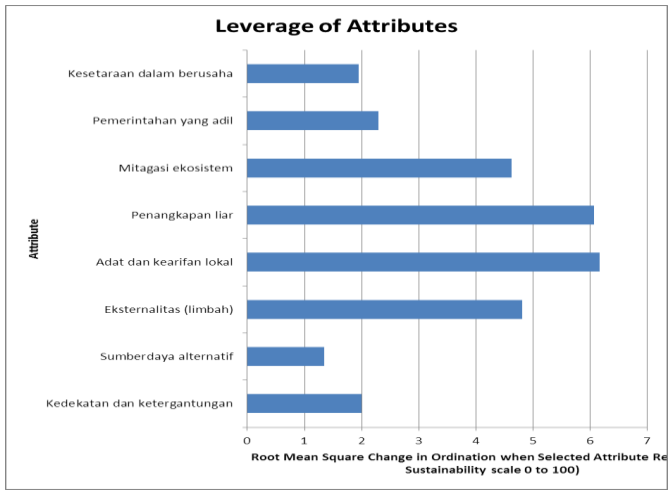

Figure 19. Leverage ethical dimensions

For the infrastructure dimension, the public transport attribute (8.92) is very dominant compared to other attributes in influencing sustainability in terms of infrastructure (Figure 20). This public transportation attribute has the highest score, which shows that there is a need for coordination with the government regarding the flow of public transportation to Taman Kili Kili Beach because there is still a lack of public transportation operating in the turtle conservation area.

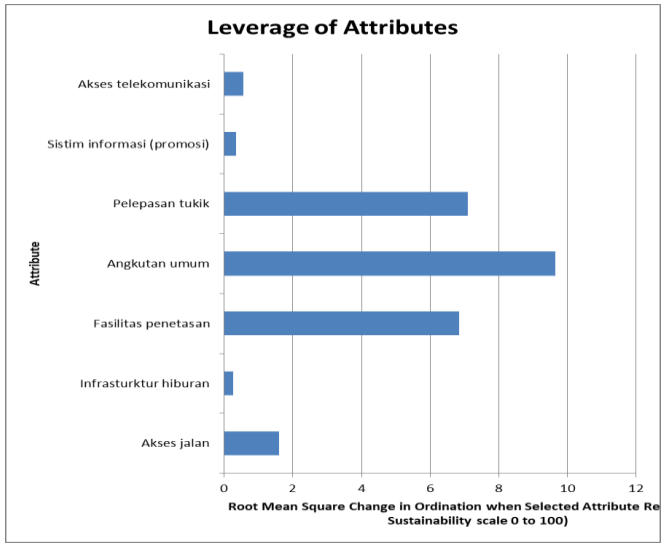

Figure 20. Leverage of infrastructure dimensions

Conclusion

Based on the results and discussions that have been described on turtle conservation at Taman Kili-Kili Beach, Wonocoyo Village, it can be concluded as follows: The management of turtles in the Turtle Conservation area of Kili-Kili Park is carried out by several activities including: Searching for turtle eggs, breeding process, hatchling rearing process, releasing hatch into the sea. Sustainability based on the results of Rapfish for Conservation at Taman Kili Kili Beach is categorized as sustainable, but there needs to be more attention to the institutional and infrastructure dimensions.

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Author Contributions
Conceptualization; J. AB. M.; M. A. T, J. M. S. T., M. W., F. S.: methodology; J. AB. M., validation; M. A. T; formal analysis.; J. M. S. T..: investigation.; M. W., resources; F. S: data curation: J. AB. M.: writing—original; M. A. T: draft preparation; J. M. S. T: writing—review and editing: M. W; visualization: F. S. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest
The authors declare no conflict of interest.

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