World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Ecotourism Suitability of Rouwno Kima Garden in Roon District, Teluk Wondama Regency

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World Journal of Advanced Research and Reviews, 2025, 28(03), 2054-2065

Publication history: Received 17 November 2025; revised on 22 December 2025; accepted on 25 December 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.3.4083

Abstract

The Rouwno Giant Clam Garden was a coastal area within the utilization zone of Cenderawasih Bay National Park (TNTC) with high potential for the development of conservation-based marine ecotourism. This study purpose was to assess the area's suitability as an ecotourism destination using the Tourism Suitability Index (TIC). Data collection was conducted through direct observation of biophysical parameters such as clam species, coral cover, depth, clarity, current velocity, beach type, and other aquatic ecological characteristics. Four clam species and coral reef conditions were found, with an average coral cover of 74%, indicating a good coastal ecosystem. The TIC of 2.445 placed the Rouwno Giant Clam Garden in the "Suitable" category for marine ecotourism, particularly snorkeling and educational tours of clams. However, several factors, such as beach width, remain limitations that require consideration in management planning. Overall, this area had strong potential for development as a conservation-based ecotourism destination involving local communities.

Keywords: Marine ecotourism; Clams; Tourism Suitability; Coral reefs; Cenderawasih Bay; Roon

1. Introduction

Ecotourism was becoming an increasingly popular tourism management approach, offering a combination of travel experiences and environmental conservation efforts. This form of tourism emphasized the importance of preserving natural resources, providing benefits to local communities, and fostering conservation awareness among visitors. In many coastal areas of Indonesia, ecotourism not only created new economic opportunities but also served as a way to protect vulnerable ecosystems such as coral reefs, seagrass beds, and marine biota habitats [1], [2].

West Papua was one of the regions with significant potential for marine ecotourism development. This region lied in the heart of the Coral Triangle, a region with the highest levels of marine biodiversity in the world. Not only do West Papua's coastal ecosystems boast hundreds of fish and coral species, but they were also home to a variety of charismatic biota, including giant clams (Tridacna spp.), which could serve as both a tourist attraction and an environmental education platform [3].

One location with this potential was the Rouwno Giant Clam Garden in Roon District, Teluk Wondama Regency. This area was within the Cenderawasih Bay National Park (TNTC), a marine conservation area of national importance. The

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Rouwno Giant Clam Garden boasts a complete coastal ecosystem—white sandy beaches, expansive seagrass beds, and extensive coral reefs. What made this area even more special was the presence of four species of giant clams: Tridacna gigas, Tridacna derasa, Tridacna squamosa, and Tridacna maxima. These four species were known as indicators of ecosystem health because they thrive only in clear, stable, and minimally disturbed waters [4].

The presence of this giant clam garden offers a significant opportunity to develop educational marine tourism. Tourists not only enjoy the underwater beauty but also learn about the importance of preserving giant clams and coral reefs. Furthermore, the local community in Roon District already had a strong maritime culture, making the development of community-based ecotourism highly feasible. This approach not only helped to increase community income but also encouraged them to participate directly in preserving the area [5].

Despite its significant potential, tourism development still requires careful consideration. Poorly managed tourism activities could cause damage, particularly to coral reefs, which were highly sensitive to physical pressures such as tourist footfall, ship anchors, or changes in water quality [6]. Therefore, before tourism development was undertaken, a scientific study was needed to determine the biophysical suitability of the Rouwno Kima Garden for ecotourism activities.

To date, no research had specifically assessed the suitability of this location for marine ecotourism. However, such an analysis was crucial for decision-making and planning sustainable tourism development. This was the primary reason for conducting this research.

This research purpose was to assess the biophysical conditions of the Rouwno Kima Garden and determine its suitability for development as a marine ecotourism area, specifically for snorkeling and educational clam tourism. Furthermore, this research was expected to provide management recommendations that supported conservation and the role of local communities in the TNTC area.

2. Research Method

2.1. Research Time and Place

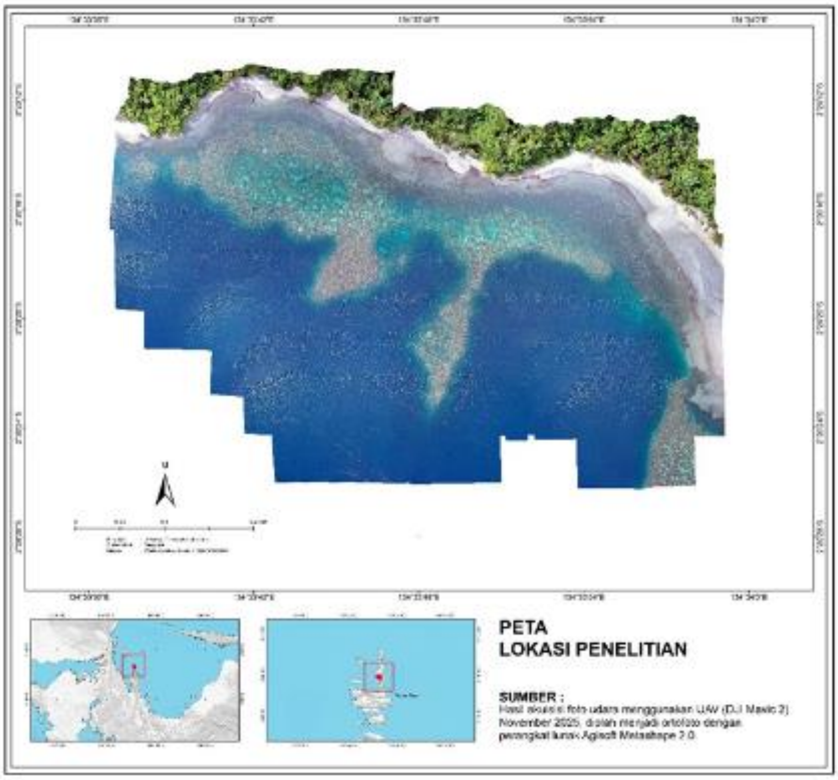


Figure 1 Research Location Map

This research was conducted from October to November 2025 at the Rouwno Clam Garden, Roon District, Teluk Wondama Regency, West Papua. Administratively, the research location was within the Cenderawasih Bay National Park (TNTC), while geographically it was located on a small island group with coastal characteristics consisting of mixed sandy beaches, seagrass beds, and coral reefs. The research location was a natural habitat for clams and had been traditionally managed by the community as a clam conservation area, thus having ecological value as well as ecotourism potential. Mapping was conducted using a UAV (DJI Mavic Drone) to obtain information on the boundaries of coral reefs, the extent of seagrass beds, the width of beaches at various points, and the general condition of the coast and shallow waters.

2.2. Tools and Materials

This research utilized various field tools to support biophysical measurements in the area. Handheld GPS was used to determine the coordinates of observation points, while UAVs were utilized for mapping coral reefs and seagrass beds. Water clarity was measured using a Secchi disk, while current speed was determined using a simple buoy and a stopwatch. Observations of beach conditions were conducted using a tape measure and clinometer to measure the width and slope of the beach. Underwater observations were conducted using snorkeling equipment and an underwater camera to document the substrate, coral, and the presence of giant clams. Underwater data collection was recorded using a special whiteboard (aqua note). In addition to primary data, this research also utilized secondary data in the form of area maps, scientific literature, and other supporting documents to strengthen the interpretation of the results.

2.3. Research Procedure

This study used a quantitative descriptive approach to assess the biophysical conditions and suitability of the area for marine ecotourism activities. Observation points were determined purposively in areas representing the distribution of coral, seagrass, and giant clam habitats. Coral cover was observed using the 50-meter Point Intercept Transect (PIT) method, where the type of bottom cover, such as live coral, coral rubble, sand, or another biota encountered, was recorded at every 50 cm interval. Giant clam identification was performed through snorkeling, observing the morphological characteristics of each individual based on reliable identification guidelines. Water clarity was measured using a Secchi disk, while depth was obtained using manual measuring instruments, and current velocity was calculated using a current meter. Beach width and beach type were observed directly in the field, and beach slope was measured using a clinometer.

All biophysical data were then analyzed using a modified Tourism Suitability Index (TKI) method [7]. Each parameter was weighted according to its importance in supporting marine ecotourism activities and scored based on actual conditions in the field. The IKW value was obtained by adding all the results of multiplying the weights and scores, which were then classified into four suitability categories: highly suitable (≥ 2.5), suitable (2.0–2.49), unsuitable (1.0–1.99), and very unsuitable (< 1). The results of this analysis were used to assess ecotourism feasibility and formulate recommendations for conservation-based management.

2.4. Data Analysis

The development of marine ecotourism required a match between coastal resources and environmental conditions with established criteria. This alignment was intended to ensure that the characteristics of tourism resources align with existing potential. Developed tourism activities need to be tailored to the resource potential and its intended use. Each type of tourism had specific requirements related to resources and environmental conditions, consistent with the tourism object to be developed. Data collection on the suitability parameters for the Rouwno Kima Garden tourist destination, integrated with the coastal area, was conducted using a modified method [7].

Table 1 Resource Suitability Parameters for the Rouwno Kima Garden Tourist Destination**.**

No	Parameter	Value	Category	Score
1	Types of clams	0,125	≥6	3
			4–5	2
			2–3	1
			0–1	0
2	Coral community cover (%)	0,1	>75	3

			>50–75	2
			25–50	1
			<25	0
3	Types of life forms	0,09	>12	3
			<7–12	2
			4–7	1
			<4	0
4	Types of coral fish	0,09	>50	3
			30–50	2
			10–<30	1
			<10	0
5	Water clarity (%)	0,09	>100	3
			>80–100	2
			20–<80	1
			<20	0
6	Depth of coral reef (m)	0,08	1–3	3
			>3–6	2
			>6–10	1
			>10; <1	0
7	Beach Wides (m)	0,08	>15	3
			10–15	2
			3–<10	1
			<3	0
8	Beach Types	0,08	White Sand	3
			White sand mixed with coral fragments	2
			Black sand, slightly steep	1
			Muddy, rocky, steep	0
9	Current Speed (cm/detik)	0,075	0–17	3
			17–34	2
			34–51	1
			>51	0
10	The width of the flat expanse of coral (m)	0,070	>500	3
			>100–500	2
			20–100	1
			<20	0
11	Coastal slope (º)	0,050	<10	3
			10–25	2
			>25–45	1

			>45	0
12	Basic water materials	0,050	Sandy	3
			Sandy Coral	2
			Muddy sand	1
			Mud, sandy mud	0
13	Coastal land closure	0,010	Coconut, open land	3
			Bushes, thickets, low, savanna	2
			High thicket	1
			Mangrove forests, settlements, ports	0
14	Dangerous biota	0,005	Not existed	3
			Sea urchins	2
			Sea urchins, stingrays	1
			Sea urchins, stingrays, lionfish, sharks	0
15	Freshwater availability/ distance to freshwater source (km)	0,005	<0,5	3
			>0,5–1	2
			>1–2	1
			>2	0

Source: Modification [7]

The suitability of resources for marine tourism was calculated based on each type of tourism activity. Each type of tourism had its own set of aquatic resource and environmental parameters that served as a reference in assessing its suitability. Each parameter had a different level of importance or attractiveness to the value of marine tourism. These parameters were then measured or assessed for their natural condition using a specific score. The resulting score was then combined with the weight of each parameter to determine the level of resource suitability for each type of marine tourism [7]. The formula used to calculate the Marine Tourism Suitability Index (IKW) was:

$$\text{IKW} = \sum_{i=1}^{n}(\text{Bi x Si})$$

Notes:

IKW : Tourism suitability index;
n : Number of conformity parameters
Bi : Parameter Valuet to i
Si : Parameter score to i

The calculation results were then classified into four levels of area suitability for tourism, namely:

Very Suitable = IKW ≥ 2,5
Suitable = 2,0 ≤ IKW < 2,5
Not Suitable = 1 ≤ IKW < 2,0
Very Not Suitable = IKW < 1

3. Results and Discussion

The suitability of the ecotourism area at the Rouwno Kima Garden was analyzed based on several biophysical parameters based on the Tourism Suitability Index (TKI) matrix. Each parameter was weighted according to its level of influence on marine ecotourism activities and a score reflecting actual conditions in the field. The suitability value of the area was calculated using the TKI formula developed by [7], allowing for measurable and consistent assessment.

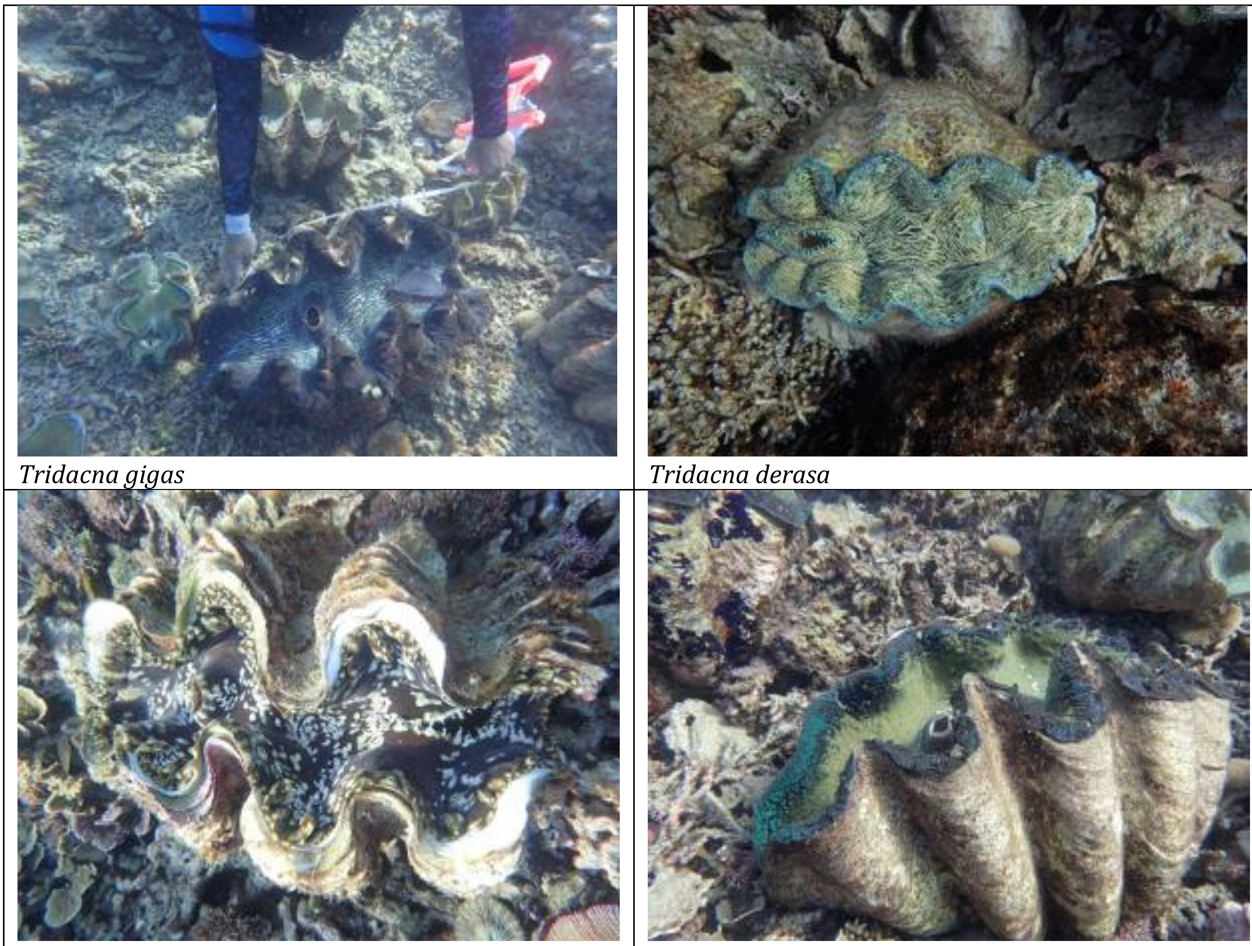
The results of the ecotourism suitability analysis of the Rouwno Kima Garden were displayed in the TKI matrix, which contained the weights, scores, and final values for each parameter. The total suitability value was obtained by multiplying the weights and scores of all parameters, which were then summed up to produce the TKI value for the area.

This value was then compared with the maximum value to determine the area's suitability category as a marine ecotourism location. Thus, the TKI analysis provided a quantitative overview of the suitability of the Rouwno Kima Garden for development as a marine ecotourism destination based on clam conservation.

Table 2 Assessment of Parameters for the Ecotourism Suitability Analysis of Kima Rouwno Garden

No	Parameter	Value	Measurement results	Score	Value
1	Kima type	0,125	4 types	2	0,25
2	Coral community cover (%)	0,1	74%	2	0,2
3	Types of life forms	0,09	17 types	3	0,27
4	Types of coral fish	0,09	35 types	2	0,18
5	Water clarity (%)	0,09	100%	3	0,27
6	Depth of coral reef (m)	0,08	2.7 meter	3	0,24
7	Width of the beach (m)	0,08	5,70 meter	1	0,08
8	Beach type	0,08	White sand mixed with coral fragments	2	0,24
9	Current velocity (cm/sec)	0,075	13,33 cm/sec	3	0,225
10	The width of the flat expanse of coral (m)	0,070	513 meters	3	0,21
11	Coastal slope (º)	0,050	6.067°	3	0,15
12	Basic water materials	0,050	Sand	3	0,15
13	Coastal land closure	0,010	Coconut and open	3	0,03
14	Dangerous biota	0,005	Not existed	3	0,015
15	Freshwater availability/distance to freshwater source (km)	0,005	0,3 km	3	0,015
Total					2,445
Suitability Class					Suitable

Field identification results indicate that four types of clams were directly found at the research site: Tridacna derasa, Tridacna gigas, Tridacna squamosa, and Tridacna maxima. These four species belong to the giant clam group, commonly found in tropical coral reefs and often serve as indicators of ecosystem health [7]. The presence of these four species suggests that the Rouwno Clam Garden had coral reef conditions that support the presence of large sessile organisms. However, interviews with the garden managers indicated that the actual number of clams at the site was much higher than the survey findings. According to the managers, there were approximately 300 individual clams spread across the nursery area and coral beds. They also explained that the clam species at Rouwno were not limited to these four species, but also include Hippopus hippopus and Tridacna crocea. In addition to clams, the managers also mentioned the presence of other charismatic organisms such as Cassis cornuta and Charonia tritonis, which were known to act as natural predators of sea urchins, making them important in maintaining the balance of the coral reef ecosystem. Additional information from the manager provided an indication that the diversity of clams at the location was higher, but not all of them were successfully identified in the field due to limited time, water conditions, and the scope of the observation area. This high diversity of clams was very relevant as an ecotourism attraction, especially for special interest tours such as educational snorkeling, considering that clams were protected biota that had high aesthetic and ecological value [8].



Tridacna gigas | *Tridacna derasa*
Tridacna maxima | *Tridacna squamosa*

Figure 2 Types of Kima

Observations of coral cover across three transects in the Rouwno Clam Garden indicate that the coral reefs were in good condition, with an average live hard coral cover of 74%. This value was well above the threshold for the "good" category according to the standard classification, which states that cover above 50% was considered good. According to the matrix [7], a cover of 50–75% was scored as 2, indicating that the area still supports snorkeling activities. This high percentage indicates that the underwater habitat structure in this area was still maintained and plays an optimal role as a home for various marine biota, including clams and reef fish. Other components such as soft corals (8%), algae (0.33%), and rocks (9%) indicate a reasonable composition for a healthy coral reef ecosystem. The low percentage of algae indicates that there was no excessive competition between algae and hard coral, something that was usually an indicator of environmental disturbances such as eutrophication or anthropogenic pressure. The presence of sand (6%) and other biota (2.67%) provides a variety of microhabitats that also support species diversity in this area. The low occurrence of coral fragments on all transects (0%) indicates that the level of physical damage to the coral due to human activity and waves was relatively low. [10] emphasized that coral cover was one of the primary indicators in assessing the suitability of snorkeling tourism because it affected the aesthetics and the presence of coral fish as a tourist attraction.

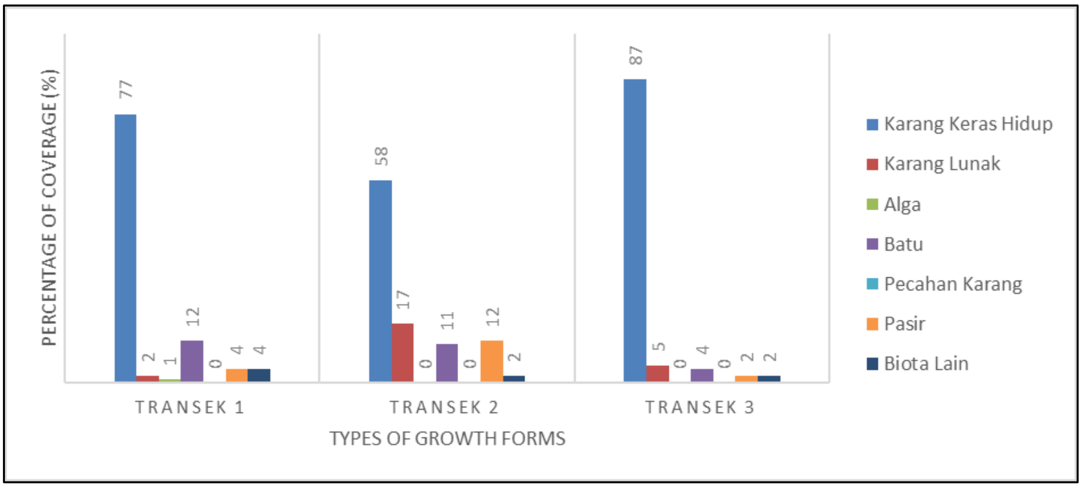


Figure 3 Percentage of Coral Cover

Observations of life forms indicate that the coral reef community structure at the Rouwno Kima Garden was dominated by massive coral (31.33%) and branching coral (19%). The dominance of massive coral generally reflects relatively stable water conditions because this group was resistant to currents and waves (and was stronger against physical stress). Meanwhile, the presence of relatively high levels of branching coral indicates that this habitat also supports the growth of more sensitive and fast-growing corals.

Other species, such as soft coral (8%), mushroom coral (4.67%), and foliose coral (3.67%), were present in lower percentages but still contribute to the diversity of habitat structure. This diverse coral type reflects the site's good ecosystem complexity and provides space for a variety of marine organisms, including clams, reef fish, and other macrofauna.

Non-coral substrate components, such as dead coral (7.67%), rubble (6%), and rock (1%), still occur in reasonable quantities. The relatively small percentage of dead coral indicates that the ecosystem was relatively healthy and not experiencing significant stress. The percentage of Macroalgae, Coralline Algae, and other CA (<1%) was also low, which was generally a positive indicator because excessive algae could be a sign of eutrophication or ecosystem disturbance. [9] also stated that "the diversity of coral forms plays a big role in improving the quality of the snorkeling experience".

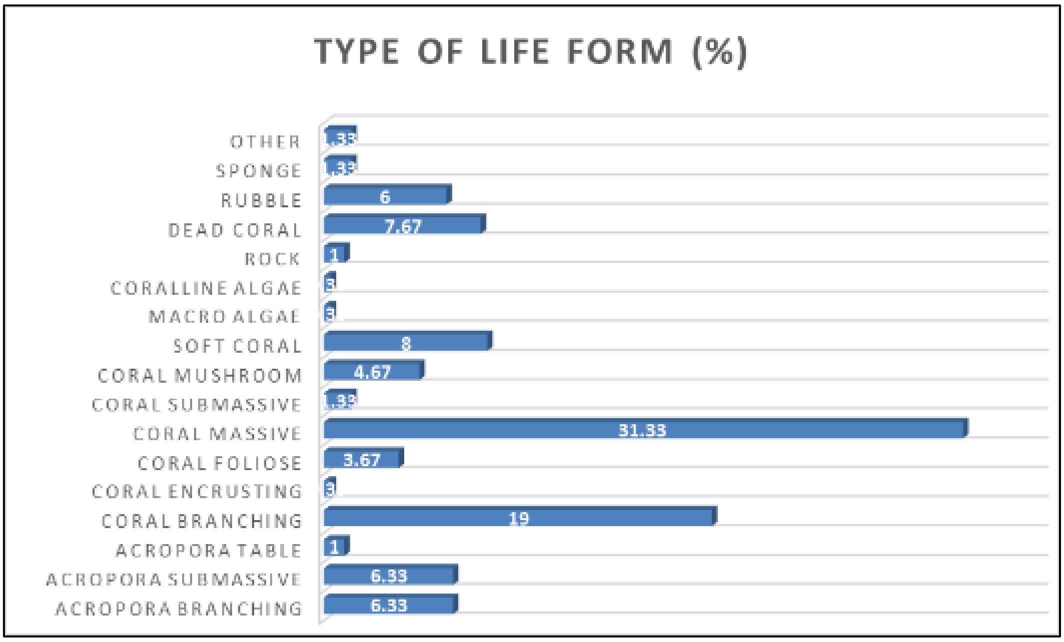


Figure 4 Types of Life Forms

The discovery of 35 species of coral fish indicates a healthy ecosystem. In a study [10], the range of 30–50 species of fish was given a score of 2 and was considered adequate for snorkeling tourism because it provided opportunities for visual interaction for visitors. Despite the score of 2, observations at the Rouwno Kima Garden showed that the number of individual fish of each species was relatively abundant. This high abundance creates a more interesting underwater experience, as tourists could see schools of fish with diverse activities and dynamic movements. This means that even though the number of species was in the medium category, the abundance of individuals greatly strengthens the tourist attraction and adds aesthetic value to snorkeling activities.

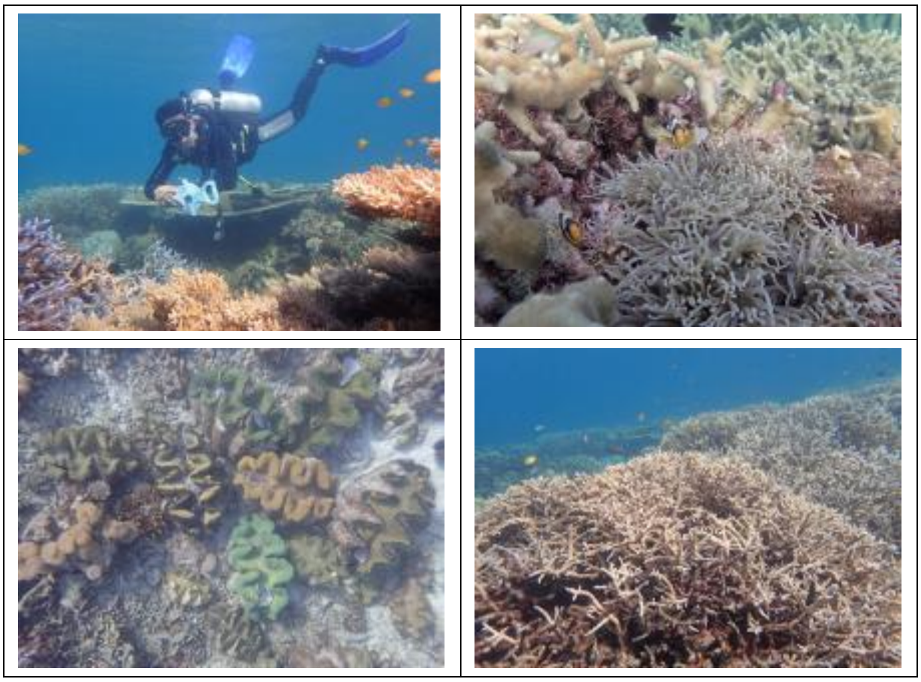


Figure 5 Condition of Kima Rouwno Garden

A transparency of 100% was excellent for snorkeling. [8]. (2020) stated that waters with a transparency of >80% were associated with tourist comfort and safety because they facilitate underwater orientation. This depth was within the ideal range (1–3 m) for beginner snorkelers. According to the matrix [7], shallow depths minimize risks and increase tourists' opportunities to observe biota up close. [10] also recommends a zone of 1–3 m as the optimum depth for non-diving marine tourism.

Narrow beach width was a limiting factor. In a study [8], beaches with a width of <10 m were categorized as less conducive to intensive beach activities, especially for tourism support facilities such as transit areas, gazebos, or tourist access routes. This type of beach was aesthetically pleasing but less comfortable for excessive activity. [9] explained that white sand mixed with coral was still considered good for beach ecotourism, although it requires additional management related to tourist safety. A beach width of 5.7 meters received a score of 1 according to the suitability matrix. However, in the context of field conditions, it was important to note that although the beach width was physically limited, there was a land area close to the community huts that functions as a rest area or preparation point for tourists before snorkeling. This means that functionally the location was still able to support tourism activities, even though the beach width was not very wide. Considerations such as this were common in community-based ecotourism locations, especially on small islands [9].

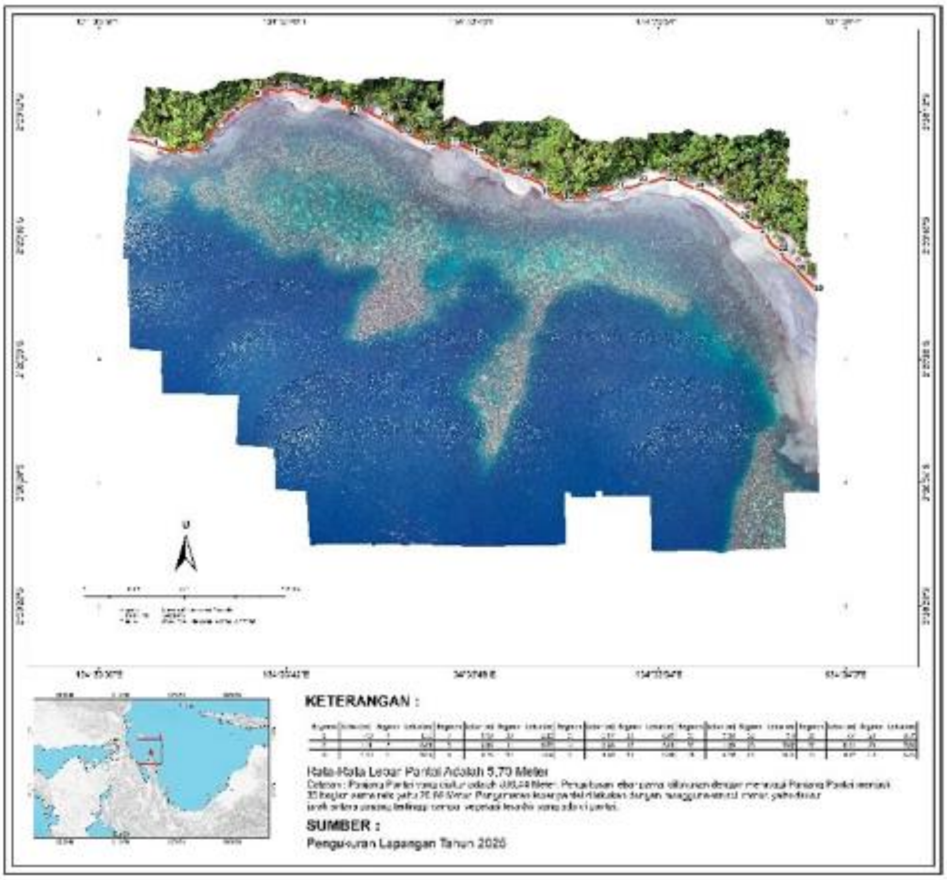


Figure 6 Beach Width Map

Low currents were ideal for marine tourism. In a study [11], currents <17 cm/s were considered safe for snorkeling and reduced the risk of tourist accidents. The vast expanse of coral reefs provides aesthetic and habitat advantages. A study by Fikri et al. (2023) emphasized that a flat coral area >500 m was an important characteristic for high-category marine tourism areas because it facilitates snorkeling activities and ecosystem education.

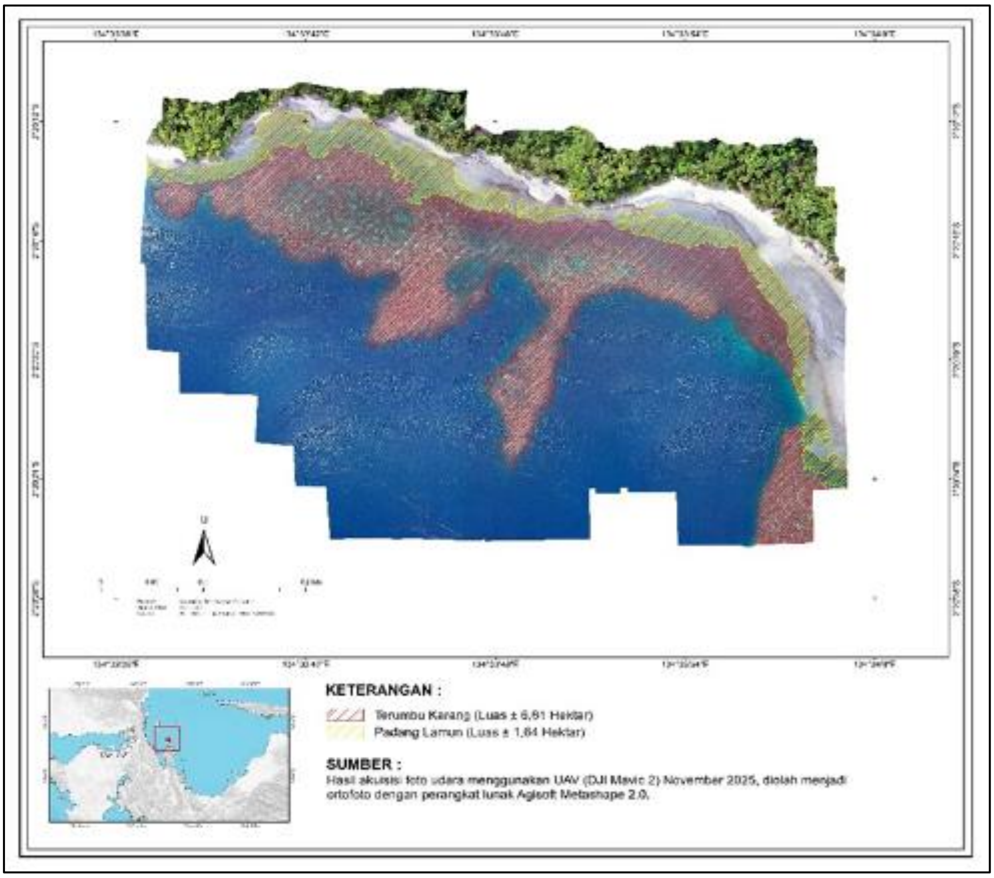


Figure 7 Coral Coverage Width Map

A gentle slope of <10° strongly supports tourism access. [8] states that a gentle slope increases visitor safety and reduces the risk of slipping due to coastal waves. Sandy substrates were the most ideal for aquatic recreation activities, as [9] found, which states that sand provides the highest level of comfort for tourists compared to a mixture of mud or coarse coral fragments.

Land cover consisting of coconut palms and open areas was considered the most supportive for tourism. [12] explains that coconut vegetation provides natural shade and aesthetics that beach visitors enjoy. The absence of dangerous biota such as sea urchins or stingrays was an added value for tourism safety. [10] emphasizes that the presence of dangerous biota could significantly reduce the tourism suitability score by increasing the risk of injury. Proximity to freshwater sources was considered highly supportive for tourism activities. [9] lists freshwater facilities as a priority supporting facility in the development of sustainable coastal tourism.

4. Conclusion

The research results indicate that the Rouwno Clam Garden had biophysical conditions that support the development of conservation-based marine ecotourism. With a Tourism Suitability Index (IKW) of 2.445, the area was categorized as "Suitable" for tourism activities such as snorkeling and clam educational tours. The presence of four identified clam species—Tridacna derasa, T. gigas, T. squamosa, and T. maxima—is an important indicator of ecosystem quality, reinforced by management information regarding the presence of over 300 individual clams and additional species such as Hippopus hippopus, T. crocea, Cassis cornuta, and Charonia tritonis.

The aquatic ecosystem was of excellent quality. Hard coral cover averages 74%, dominated by massive and branching coral lifeforms, indicating a stable and diverse habitat. Other water parameters, such as high transparency, ideal snorkeling depths, low currents, and extensive coral reefs, further strengthen the area's suitability. However, several factors, such as the relatively narrow beach width, pose limitations, although the lowland area near the community huts still supports tourism activities.

Overall, the ecotourism potential of the Rouwno Kima Garden was supported by the richness of its clam biota, the healthy condition of its coral reefs, and the social support of the local community, which had long protected the area. With proper management—through visitor management, improved facilities, and strengthened conservation functions, this area had great potential to become a model for sustainable, community-based marine ecotourism in Cenderawasih Bay.

Compliance with ethical standards

Acknowledgment

Permission to conduct research within the Cenderawasih Bay National Park (TNTC) area was facilitated by the park management authority. The authors extend their gratitude to the Roon community for providing their time, assistance, and local knowledge, which greatly supported the research activities.

Disclosure of conflict of interest

The authors declare no conflict of interest regarding the publication of this paper.

Statement of Ethical approval

This study did not involve any experimental procedures on animals or interventions on human subjects. All research activities consisted of ecological field observations and non-invasive data collection; therefore, formal ethical approval was not required.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

References

[1] TIES (The International Ecotourism Society). (2015). What was ecotourism? The International Ecotourism Society.

[2] Buckley, R. (2016). Tourism and the oceans. CAB International.

[3] Spalding, M., Burke, L., Wood, S. A., Ashpole, J., Hutchison, J., & Ermgassen, P. (2018). Mapping the global value and distribution of coral reef tourism. Marine Policy, 82, 104–113. https://doi.org/10.1016/j.marpol.2017.05.014

[4] Neo, M. L., Eckman, W., Vicentuan, K., Teo, S. L., & Todd, P. A. (2015). The ecological significance of giant clams in coral reef ecosystems. Biological Conservation, 181, 111–123. https://doi.org/10.1016/j.biocon.2014.11.004

[5] Pomeroy, R. S., Parks, J., & Watson, L. (2016). How was your MPA doing? A guidebook for evaluating the management effectiveness of marine protected areas. IUCN.

[6] Garrod, B., & Gössling, S. (2021). New frontiers in marine tourism: Sustainable development, management, and opportunities. Routledge.

[7] Yulianda, F. (2019). Conservation-based marine ecotourism: Principles, concepts, and applications of marine tourism suitability. IPB Press.

[8] Badriani Ohi, S., Lihawa, F., & Zainuri, A. (2020). Land suitability analysis study for Love Tree Beach and Lahe Island tourism. Jurnal Pendidikan Geografi, 7(1), 41–49. https://doi.org/10.34312/jpg.v7i1.59570

[9] Puttileihalat, M. S., Lelloltery, H., & Tuhumury, A. 2023. Ecotourism study based on area suitability on Pombo Island Beach, Central Maluku Regency. Jurnal Sylva Scienteae, 6 (2), 337–345. https://doi.org/10.33024/jss.v6i2.8132

[10] Fikri, M. N., Fadli, N., & Muttaqin, E. (2023). Study of the suitability of snorkeling tourism based on the condition of coral reefs in Indonesian waters. Jurnal Ilmiah Samudra Akuatika, 6(1), 45–55. https://doi.org/10.33059/jsa.v6i1.6829

[11] Yudhistira, E., & Komarudin, N. 2021. Analysis of the suitability and carrying capacity of coastal ecotourism in Ciletuh Bay. Jurnal Akuatek, 2(2), 104–111.37486-133542-1-PB. https://doi.org/10.32529/akuatek.v2i2.133542