

## Transformation of Fish Apartment into a Marine Ecotourism Village of Tegineneng, Limau District, Tanggamus Regency

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### Abstract

*The fish apartment in Pekon Tegineneng, Limau Sub-district, Tanggamus Regency, was initially established as an artificial habitat aimed at supporting the recovery of fishery resources by protecting spawning and nursery grounds. With a 32% increase in tourist visits by 2024, the area has gradually transformed into a marine ecotourism destination involving the participation of the Tourism Awareness Group (Pokdarwis). This activity aimed to strengthen the capacity of Pokdarwis to manage conservation-based ecotourism, improve community welfare, and preserve the sustainability of the fish apartment ecosystem. The methods employed included training sessions, facilitation of ecotourism governance planning, focus group discussions (FGDs), and pilot implementation of the governance model accompanied by facilitators from the State Polytechnic of Lampung over a three-month period. The results indicate that through the integration of SWOT analysis and community empowerment, a participatory strategy for managing fish apartment-based ecotourism was developed, leading to improved management capacity, enhanced branding, and the diversification of tourism products rooted in local wisdom and environmental conservation.*

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## 1. INTRODUCTION

A fish house, also known as a fish apartment, is a structure constructed from polypropylene plastic that is placed on the bottom of the water. Its primary function is to provide a spawning area for adult fish (*spawning ground*) as well as being a place of protection, care, and rearing of eggs and young fish (nursery ground) to support the recovery of fish resource stocks. Fish Apartment is designed in a modular form, consisting of several components such as the main module, attractor, and weights. Each partition is equipped with numerous gaps resembling apartments, so it can provide a safe and comfortable habitat for fish, shrimp, and crabs that are spawning. This structure also protects the parent fish laying eggs, larvae or juveniles. Fish houses are usually placed in coastal waters at a distance of 2–6 miles from the shoreline at a depth of 20–30 meters, and are resistant to saltwater for up to 30–50 years.

The Tourism Awareness Group (Pokdarwis), which is part of the Core People's Cooperative of Tegineneng Village, Limau District, Tanggamus Regency, received a grant for an apartment from BPPI in 2023. Management of the ecotourism area in the region has been carried out collaboratively between the Tourism Awareness Group (Pokdarwis) and the surrounding community. As managers, Pokdarwis recognizes the threats to ecosystem sustainability, although

knowledge constraints and limited access to information remain challenges in implementing sustainable tourism management concepts.

Routine monitoring results show significant improvements in the artificial ecosystem and fish resources since the fish apartment installation. Within two years of installation, the area experienced algae growth, soft coral growth, coral recruitment, and became a new habitat for various fish species. The success of this ecosystem rehabilitation is reflected in the 32% increase in snorkeling visits by 2024.

Increasing interest of tourists to snorkel around Fish Apartment has a positive impact on the local economy, particularly through the provision of tourism-related goods and services. However, concerns about environmental sustainability—particularly the damage to artificial ecosystems caused by irresponsible snorkeling and waste pollution—remain a pressing issue. Unwise tourism practices can cause physical damage to coral reefs, while consumer waste reduces aesthetic appeal and exacerbates environmental degradation.

Pokdarwis, which is entrusted with the sustainable management of fish apartment and ecotourism, recognizes the need to increase knowledge and capacity in tourism management based on conservation principles and supporting sustainable fisheries programs. The human resource development program, through training, mentoring, focus group discussions (FGDs), and piloting the implementation of tourism management, involving tourism and ecology practitioners from the Lampung State Polytechnic, is expected to be a strategic investment in strengthening marine ecotourism management, while simultaneously supporting the sustainability of the coral reef ecosystem around the fish apartment.

## 2. IMPLEMENTATION METHOD

Community Service Activities with the title Transformation of *Fish apartment* Becoming a Marine Ecotourism: Empowerment of the Tourism Awareness Group (Pokdarwis) of Tegineneng Village, Limau District, Tanggamus Regency will be held for three months, from June to August 2025. Training, mentoring, and FGD activities will be held at the Inti Rakyat Cooperative office, located in Tegineneng Village, Limau District, Tanggamus Regency, while the practice of implementing governance will be carried out in the tourist area, including at the snorkeling spot around the fish house. The following is the location of the fish house in Limau Waters.

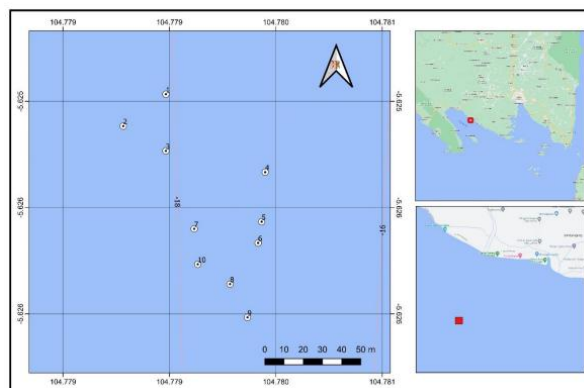


Figure 1. Location of Fish House Colony in Limau District

### Activity Stages

Community Service (PKM) activities are implemented through four main, structured stages to ensure program success and strengthen collaboration between the proposing team, cooperative partners, and the community. Intensive coordination with cooperative management is a crucial foundation, not only to ensure active partner participation but also to build mutually reinforcing networks and trust.

#### 1. *Ecotourism Management Concept Formulation Training*

Objective: Pokdarwis is expected to understand the concept of ecotourism and be able to identify local potential and attractions that support ecotourism development.

Activity Description: This activity involved collaboration between the Community Service Program (PKM) team, cooperative managers, conservation cadres, and the Tegineneng Village and sub-district governments. The meeting was held semi-formally, with the following agenda:

- Introduction of the proposing team from Lampung State Polytechnic (Polinela)
- Greetings from the Chairman of the Cooperative
- Speech by the Village Head and local government representatives
- The core session consisted of delivering material on the theme of ecotourism management, presented communicatively and engagingly to increase public understanding, especially among those working as fishermen.

#### 2. *Assistance in the Preparation of Ecotourism Governance*

Objective: This phase aims to assist Pokdarwis in compiling an implementable ecotourism management concept document, guided directly by competent facilitators and practitioners.

Activity Description: Pokdarwis, together with facilitators, will prepare a tourism management concept based on:

- Analysis of existing location conditions
- Visitor character
- The existence of a fish house
- Tourism infrastructure facilities
- Pokdarwis' capacity in controlling tourism activities

#### 3. *Pokdarwis FGD with Community Leaders*

Objective: To explore participants' perspectives, knowledge, and experiences to develop a comprehensive ecotourism governance concept through focus group discussions.

Activity Description: The FGD was moderated by a member of the proposing team, engaging participants in active interaction and sharing opinions and experiences related to the formulation of ecotourism management concepts. The discussion aimed to build shared understanding, gain new insights, and identify group consensus.

#### 4. *Finalization and Trial of the Implementation of the Ecotourism Management Concept*

Objective:

Piloting the governance concept that has been developed over four weeks.

Activity Description:

- Recording of every aspect of implementation will be used as evaluation material at the end of the trial period.
- The evaluation is carried out comprehensively, identifying the root of the problem and formulating alternative solutions that may be implemented.
- The entire process is accompanied by facilitators from Polinela to ensure the achievement of objectives and the sustainability of the program.

Each stage supports the others in strengthening the institutional capacity of Pokdarwis and ensuring that community-based ecotourism management runs effectively and sustainably.

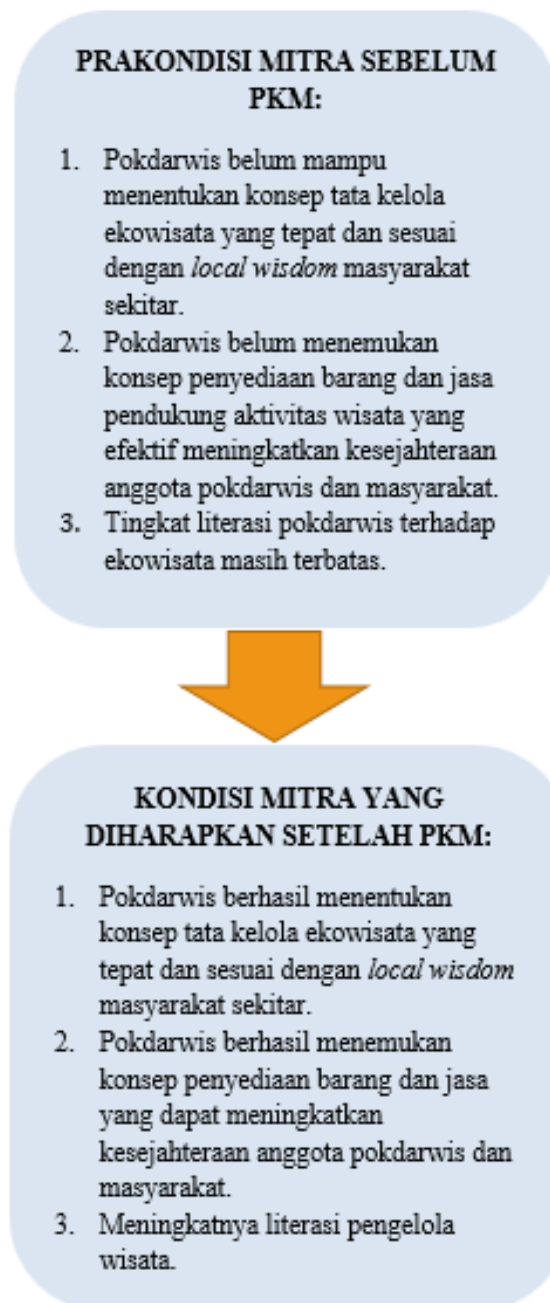


Figure 2. Expected output from PKM activities in Limau Waters

### 3. RESULTS AND DISCUSSION

Formulation of ecotourism development strategies for *Fish apartment* cannot be separated from the assessment of its development potential (Sartimbul et al., 2018). A SWOT analysis is used to identify the relationship between aspects of ecotourism resources and other resources. In this analysis, strengths and weaknesses are internal factors, while challenges and obstacles are external factors (Ginting et al., 2013). Identification of these factors is the initial step in the SWOT analysis process (Sunarsi, 2024), which then yields conclusions on realistic and implementable tourism development strategies. Formulating an ecotourism development strategy requires the involvement and feedback of various stakeholders. Key stakeholders in this process include the local community, ecotourism managers, members of the People's Core Cooperative, security forces, local community leaders, and other supporting parties.

To establish an appropriate and efficient strategy, compiling a profile of the existing conditions of activities and the environment is a crucial initial step (Handayani et al., 2023).

Profile of the existing conditions of Pokdarwis and ecotourism management of *Fish apartment* in Limau waters is explained in detail through the following SWOT diagram:

Based on the results of the SWOT diagram that has been prepared, a strategy for implementing PKM activities was formulated with a focus on determining the Fish Apartment ecotourism management concept, which includes:

1. Conduct awareness-raising and brainstorming sessions regarding fish resource recovery and the impacts arising from the successful rehabilitation of new ecosystems in fish habitat areas.
2. Developing and strengthening the capacity of Pokdarwis to be able to formulate an appropriate ecotourism management concept that is in line with the local wisdom of the surrounding community; improving the welfare of Pokdarwis members and the local community; and strengthening Pokdarwis' ability to transfer insights and knowledge regarding the area of *Fish apartment* for the visitors.

### Quantitative approach to SWOT analysis

Ginting et al. (2013) explained that the quantitative approach to SWOT analysis involves analyzing all identified SWOT factors by assigning a weighted score ranging from 1 (very important) to 0 (not important), with a cumulative total weighting of 1. Internal and external factors are then grouped on a rating scale ranging from 1 (very bad) to 4 (very good) based on the priority of the influence of the opportunities and strengths on the organization. Threats and weaknesses, on the other hand, are assessed with a negative score ranging from -4 to -1. This scoring and weighting aim to determine the position of ecotourism of *Fish apartment* in the SWOT diagram quadrant so that development strategies can be determined more objectively and measurably.

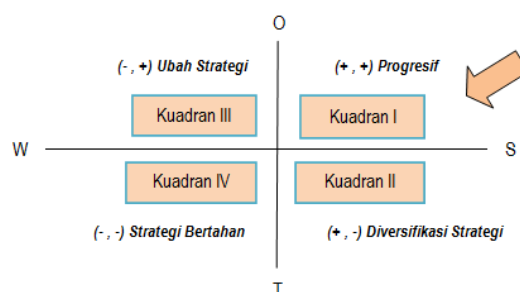


Figure 3. SWOT diagram

Quadrant I reflects the correlation between strengths and opportunities that result in the most favorable conditions or strategies. In this situation, strategies that are *growth oriented* required by implementing an aggressive growth policy.

Quadrant II describes the relationship between strengths and threats, where the right strategy is to utilize existing strengths to face long-term threats and diversify the business, both in terms of products and markets.

Quadrant III shows the correlation between opportunities and weaknesses, so tourism managers must minimize internal problems to maximize the potential for significant market opportunities. Meanwhile, Quadrant IV represents situations that should be avoided because they have the potential to harm tourism management, particularly those that negatively impact the organization's internal aspects (Sunarsi, 2024).

Determining the position of the ecotourism *Fish apartment*. This analysis was conducted using a quantitative approach using a SWOT diagram. This analysis involves calculating the weights and rankings of factors included in internal and external criteria. The following table presents the results of the weighting and ranking of these internal and external factors.

Table 1. Weight and ranking of internal factors

No	Internal Factors	Weight	Rating	Score
	<b>Strength</b>			
1	Pokdarwis is committed to maintaining and caring for the <i>Fish apartment</i>	0,3	+4	1,2
2	Increased tourist enthusiasm based on a 32% increase in the number of visits in 2024	0,4	+4	1,6
3	The positive impact of social media that publicizes the exoticism of coral reefs and fish ecosystems of the <i>fish apartment</i> indirectly becomes a means of promotion	0,3	+3	0,9
	<b>Weaknesses</b>			3,7
1	Pokdarwis has not been able to determine the appropriate and appropriate ecotourism management concept of <i>local wisdom</i> in local communities.	0,3	-3	-0,9
2	Pokdarwis has not yet found a concept for providing goods and services to support tourism activities that effectively improve the welfare of Pokdarwis members and the community.	0,3	-3	-0,9
3	The level of literacy of Pokdarwis regarding ecotourism is still limited.	0,4	-3	-1,2
				-3,0
	$S + W = 3,7 + (-3,0) = 0,7$			

One of the main strengths lies in Pokdarwis' commitment to maintaining, caring for, and managing the *Fish apartment* as part of a valuable marine ecosystem. This commitment is evident in the regular monitoring routines and community service activities, demonstrating a sense of ownership and responsibility for the program's sustainability. The active involvement of Pokdarwis members is also a crucial foundation for realizing environmentally sustainable tourism.

Another strength is reflected in the increase in tourist visits by 32% in 2024. This surge indicates that the *Fish apartment* is starting to be widely known and appreciated by tourists, both local and from outside the region. This enthusiasm presents an opportunity to strengthen the existence of *Fish apartment* as a new marine tourism attraction in Tanggamus.

In addition, social media plays a strategic role in boosting the popularity of this destination. Visual documentation of the beauty of the coral reefs and the diversity of fish in the surrounding area of the *Fish apartment*. The widespread use of marine tourism content on platforms like Instagram, TikTok, and YouTube has indirectly served as an effective

promotional tool. The virality of this marine tourism content has paved the way for strengthening destination branding and attracting more tourists with relatively minimal promotional costs.

Despite its promising strengths, this transformation process also faces challenges stemming from internal weaknesses. One of the most glaring is the inability of the Tourism Awareness Group (Pokdarwis) to formulate an ecotourism management concept that aligns with the local wisdom of coastal communities. This results in spontaneous management without a structured direction, hindering the optimization of existing potential. Furthermore, the lack of an effective concept for providing tourism-supporting goods and services presents a unique challenge. Pokdarwis still struggles to develop locally based businesses such as snorkeling equipment rentals, tour guides, seafood cuisine, or unique souvenir products, which could potentially increase income for both the group and the surrounding community.

On the other hand, Pokdarwis's literacy level regarding the basic principles of ecotourism remains low. This implies a lack of understanding of sustainability, conservation, and education-based tourism services. The lack of training and mentoring creates a gap between potential and technical management capabilities.

The weighting and ranking calculations in Table 4 show that the position of the Ecotourism of *fish apartment* is on the X-axis, which is the cumulative sum of the strengths of 3.7 and weaknesses of -3.0, resulting in a value of 0.7. Thus, it can be concluded that the Poltekpel Banten Eduwisata area is on the positive X-axis. According to Ginting *et al.* (2013), in their research explained that positive values on the X axis can cover existing weaknesses in tourist locations.

The positioning of Poltekpel Banten Prestasi Beach Edutourism based on external criteria consists of challenges and threats. The following weighting and ranking calculations for each challenge and threat aspect are presented in Table 5.

Table 2. Weight and ranking of external factors

No	External factors	Weight	Rating	Score
<b>Challenge</b>				
1	The Success of <i>fish apartment</i> becomes a new habitat for marine organisms	0,4	+4	1,6
2	Support from educational institutions through DIPA Polinela in the form of PKM	0,3	+3	0,9
3	Support and hope from the Inti Rakyat cooperative and the community that ecotourism can improve the economy of the surrounding community	0,3	+3	0,9
<b>Threat</b>				3,4
1	The increasing number of visitors threatens environmental damage and an abundance of waste.	0,3	-3	-0,9
2	Snorkeling activities pose a risk of damaging coral ecosystems.	0,3	-3	-0,9
3	<i>Local wisdom</i> that applies in society will be threatened with loss due	0,4	-2	-0,8

	to the large amount of interaction with people from outside the area			
				2,5
	$O + T = 3,4 + (-2,5) = 0,9$			

The transformation of *Fish apartment* development of marine ecotourism in Pekon Tegineneng is inseparable from the influence of various external factors, including opportunities and threats to the program's long-term success. Analysis of these factors provides a strategic overview for developing adaptive, participatory, and sustainable development plans.

One of the biggest opportunities that can be exploited is the success of *Fish apartment* as a new habitat for various marine organisms. This artificial structure has created a biota aggregation area, enriched local biodiversity and simultaneously enhanced the aesthetic value of the waters, making them a major tourist attraction. This ecological success opens up the potential for developing experiential-based ecotourism, which not only attracts tourists but also raises awareness of the importance of marine conservation.

Furthermore, support from higher education institutions, particularly through the Community Service (PKM) program funded by the Lampung State Polytechnic (Polinela)'s DIPA (Award No 1000), is a strategic factor in building community capacity. This collaboration creates synergy between science and empowerment practices, with contributions in the form of training, management facilitation, and monitoring and evaluation of ecotourism activities. Academic involvement also contributes to scientific documentation and validation of the approaches used in the management of *Fish apartment* as a tourist destination.

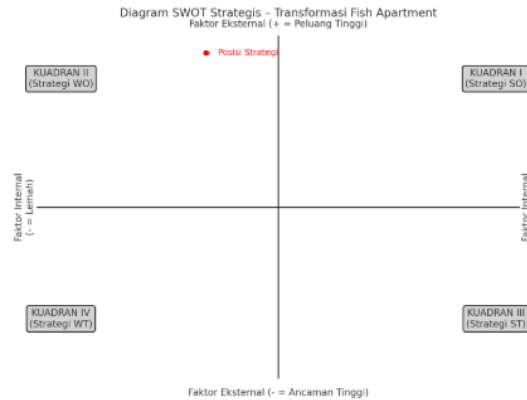
Furthermore, support from the Inti Rakyat cooperative and the local community is an external force driving the sustainability of ecotourism. The hope that tourism activities will directly impact the local economy is a strong motivation for the program's sustainability. Within the local economic context, the development of tourism-based micro-enterprises such as seafood, guide services, snorkeling equipment rentals, and small-scale lodging can create a thriving village economy and strengthen community independence.

On the other hand, the success demonstrated by the increase in tourist visits also carries the risk of environmental damage. Without proper management, the surge in tourists has the potential to increase the volume of marine and coastal waste, as well as cause ecological stress on the Fish Apartment ecosystem. This poses a serious challenge given the limited environmental carrying capacity of coastal areas and their sensitivity to change.

Another threat comes from uncontrolled snorkeling, which risks damaging the coral reef ecosystem that is beginning to grow around Fish Apartment. Direct physical contact, stepping on coral, and even the use of environmentally unfriendly sunscreens can lead to ecological degradation. The lack of regulation and oversight of underwater tourism activities increases the potential for long-term damage to the area's main attraction.

Furthermore, intensive interaction between local communities and tourists from outside the region carries the risk of losing local wisdom, which has long been part of the socio-cultural identity of coastal communities. Traditional values such as the sacredness of the sea, deliberation-based governance, and local norms of politeness can be eroded by outside cultures if not balanced by strengthening local culture in tourism management. Therefore, it is crucial to position the community as the primary actor, not simply a tourist attraction, to maintain the continuity of cultural values within the ecotourism ecosystem.

- Internal Factors (Strength + Weakness) = 0.7 → indicates that internal conditions tend to be weak
- External Factors (Opportunity + Threat) = 0.9 → indicates the existence of high external opportunities



### SWOT Diagram Image

Strategic Position: Quadrant II (WO Strategy)

Explanation:

The position of the point is in Quadrant II, which indicates that:

- Even though internal conditions (for example, Pokdarwis governance or ecotourism literacy) are still limited or weak,
- However, the external environment provides great opportunities, such as community support, ecotourism trends, and mentoring from educational institutions.

Strategi WO (Weakness–Opportunity):

The strategy that can be implemented is to take advantage of external opportunities to improve internal weaknesses, including:

- Increasing the capacity of Pokdarwis through training and collaboration with educational institutions.
- Optimizing external support (e.g., funding, social media, digital promotion) to strengthen tourism management structures and systems.
- Develop an ecotourism model that is in accordance with local wisdom, with the help of external partners such as cooperatives, universities, or NGOs.

#### 4. ACKNOWLEDGEMENT

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