



Effectiveness of Monitoring the Use of Fish Aggregating Devices in the Banda Sea Marine Conservation Area, Central Maluku

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Abstract. The continued use of fishing aids such as fish aggregating devices (FADs) and “lobe” fishing methods remains a major challenge contributing to overfishing in the Banda Sea Marine Conservation Area. Although awareness campaigns have been conducted, many fishers continue to use FADs, citing declining fish stocks within the area. While fishing activities are permitted, the use of FADs within conservation zones is prohibited, as their presence can undermine conservation objectives and lead to resource degradation. Therefore, effective supervision and management in accordance with existing laws and regulations are crucial. This study aims to evaluate the effectiveness of monitoring the use of FADs in the Banda Sea Conservation Area and its surrounding waters in Central Maluku Regency, as well as to formulate strategies for improving compliance. The study employed a questionnaire to assess the weight and value of key monitoring variables. Respondents included personnel from the Ambon PSDKP Station, KKPN Banda Work Unit, Maluku Provincial Marine and Fisheries Office, Marine Police, Navy Post, Coral Triangle Center (CTC) Foundation, and the Banda Lestari Community Group. The results indicate that the supervision of FAD use in the Banda Sea Conservation Area achieved an effectiveness score of 80.79%, categorized as effective. However, to further enhance supervision and improve community compliance, it is necessary to strengthen weaker aspects of monitoring, particularly community participation and the intensity of supervision.

Keywords: FADs, Banda Sea Conservation Area, Monitoring Effectiveness.

1 Introduction

In general, marine conservation areas can also be defined as areas that are designated and managed, either formally or informally, for the long term with the aim of protecting natural resources, ecosystem services, and cultural values (IUCN-WCPA, 2008).

Conservation areas in aquatic regions are generally established with the aim of regulating human activities and for conservation purposes. Conservation areas play an important role in protecting ecosystem sustainability, where natural resources are able to maintain their reciprocal relationships and interdependence between marine biota and their physical environment. Tourism and recreational activities can cause specific ecological problems compared to other economic activities, given that natural beauty and authenticity are key assets (Salim, 2012).

Banda Sea Marine Tourism Park (TWP), located in the Banda Neira Islands of Central Maluku Regency, is one of the National Marine Conservation Areas (KKPN) established under Decree of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia Number KEP.69/MEN/2009. The Banda Sea TWP is managed by the Kupang National Marine Conservation Agency. In its management, the utilization of the conservation area has been zoned so that permitted and prohibited activities are regulated.

Monitoring of marine resource conservation is an important element in ensuring the sustainability of protected ecosystems as part of conservation area management. Monitoring of utilization in the Banda Sea TWP Conservation Area has been carried out. The results of patrols by the Ambon Marine and Fisheries Resources Surveillance (PSDKP) Station in the 2021-2025 period still found unlicensed fishing activities and the use of fish aggregating devices (FADs) in the utilization zone. However, the widespread placement of FADs in conservation areas and the use of the "lobe" fishing method are among the causes of overfishing in the Banda Sea TWP utilization zone. The use of fish aggregating devices and the "lobe" fishing method can have an impact on conservation targets, namely the results of the evaluation of the effectiveness of the management of the Banda Sea Conservation Area in 2024, which is still at an optimum status (79.04%) and has not yet reached a sustainable status (>85%) (Kupang KKPN Office, 2025). The use of fish aggregating devices can also have negative impacts in the form of competition for limited food resources. This condition can disrupt the sustainability of fish resources (Prayitno, et al., 2021).

To prevent greater impacts, supervision is needed to ensure that utilization in conservation areas complies with legal provisions. Based on this, the author is interested in conducting research:

1. What is the current condition of monitoring the use of fish aggregating devices in the Banda Sea Conservation Area?
2. What is the institutional condition in the management of the Banda Sea Conservation Area?
3. How effective is monitoring in the Banda Sea Conservation Area?

This study covers aspects of utilization in the utilization zone of the Banda Marine Conservation Area and its surroundings. Law No. 1/2014 states that the scope of management includes coordination and planning, monitoring, utilization, and control of coastal resources and small islands. Conservation area management integrates several factors in planning, utilization, monitoring, and control, as well as aspects of study with a broader scope. Monitoring is one of the factors that can influence the overall success of management. According to Halpern et al. (2008) and Leu et al. (2008),

monitoring anthropogenic activities is a key recommendation to be implemented regularly in the protection of ecosystem areas in various regions around the world (Wahyuningsih et al, 2018). With these considerations, the scope of this study is the factors of monitoring and utilization of zones in the management of conservation areas as part of the management aspect. The purpose of this study is to analyze the effectiveness of monitoring the utilization of fish aggregating devices in the Banda Sea Conservation Area and its surroundings in Central Maluku.

2 Methods

2.1 Study Sites

The research was conducted from May to September 2025. The research location was in the Banda Sea Conservation Area and its surroundings, Central Maluku, Maluku. The research location map can be seen in Fig 1.

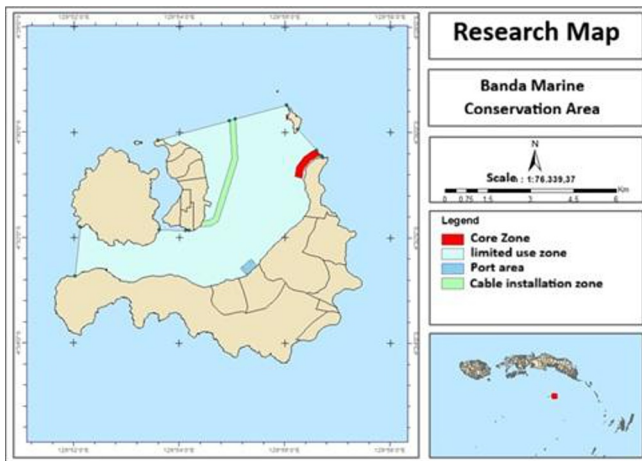


Fig. 1. Research location map

2.2 Data Collection and Analysis

Types and Sources of Data. The following are the types and sources of data used in this study is primary data and secondary data

Primary data. Primary data was obtained through direct observation and interviews. The data required included location data, anthropogenic activity data, and data on existing utilization in the Banda Sea Conservation Area. Interviews were conducted with competent individuals, namely employees of the Ambon PSDKP Station, Kupang KKP Office, the Maluku Province Marine and Fisheries Service, members of the pokmaswas, the CTC and Eco Nusa foundations, members of the Banda Marine

Police, and the Banda Navy Post, to obtain information in the form of questionnaires (Table 1).

Table 1. List of respondents for monitoring effectiveness assessment

No	Institution/Agency	Number (people)
1	Ambon PSDKP Station	26
2	Kupang KKPN Office	5
3	Maluku Province Marine and Fisheries Service	21
4	Banda Marine Police	1
5	Banda Naval Post	1
6	NGOs (CTC and Eko Nusa)	3
7	Banda Lestari Community Group	1
	Total	58

Secondary data. Secondary data was obtained by collecting data from relevant agencies in accordance with the material to be studied. The secondary data includes the PSDKP Director General Regulation Number 4 of 2022, reports on monitoring and supervision activities in the Banda Sea Conservation Area and its surroundings, the Annual Report of the Ambon PSDKP Station, and other reports containing data on biophysical conditions, threats of damage, and other information contained in the 2022-2042 Banda Sea Conservation Area management plan for Maluku Province, as well as other supporting data from the Ambon PSDKP Station.

Data Analysis.

Monitoring conditions in the Banda Sea Conservation Area. The method used to analyze the monitoring conditions in the Banda Sea conservation area is descriptive analysis. The analysis is based on the fulfillment of technical monitoring criteria in conservation areas as stipulated in Regulation of the Director General of PSDKP Number 4 of 2022 concerning Technical Guidelines for Monitoring Conservation Areas, namely the existence of monitoring institutions, monitoring resources, monitoring facilities and infrastructure, legal basis of laws and regulations, Standard Operating Procedures (SOP) for supervision, management of supervision facilities and infrastructure, community involvement in supervision, enforcement of violations, supervision reports, level of compliance or findings of supervision, and utilization of conservation areas in accordance with regulations.

Identification and classification of stakeholders. Stakeholder analysis is carried out using stages that include stakeholder identification and stakeholder classification. The data obtained is analyzed using the stakeholder analysis method (Reed et al., 2009). Identification is carried out to determine the *stakeholders* involved in the management and supervision of the Banda Sea conservation area through field observations and interviews. Stakeholders were then grouped according to their elements. Stakeholders

consisted of the elements of Academy, Business, Government, and Community (Dwyer and Edwards, 2000). The next step was to classify stakeholders. Stakeholder classification was carried out by interpreting the matrix of stakeholder interests and influence on the management and supervision of the Banda Sea Conservation Area. The influence and interest matrix was compiled based on the description of the informants' questions expressed in quantitative measures (scores) and then grouped according to the criteria of influence and interest (Table 2). Scoring was determined using questions to measure the level of interest and influence of stakeholders. The five-level data measurement is a modification of the model developed by Siregar (2011) and Roslinda et al. (2012). The scores from the five questions are added up, and the results of the scoring for the level of importance and influence of each stakeholder are grouped according to the type of indicator and then juxtaposed to form coordinates. The position of the coordinates illustrates the roles played by each stakeholder. The results of stakeholder classification based on their influence and importance are divided into four groups, namely *Key Player*, *Subject*, *Context Setter*, and *Crowd* (Bryson, 2004); (Reed et al., 2009).

Table 2. Stakeholder perception framework for conservation area management

Interest Criteria (K)	Score (K) *	Influence Criteria (I)	Score (P) **
Stakeholder coordination (K1)		Stakeholder role and participation (P1)	
Benefits for stakeholders (K2)		Contribution of stakeholder assistance (P2)	
Stakeholder authority (K3)		Solidarity and internal cohesiveness of stakeholders (P3)	
Stakeholder priorities (K4)		Stakeholder reputation (P4)	
Level of stakeholder dependence (K5)		Resources owned by <u>stakeholders</u> (P5)	

Regulatory analysis. This regulatory analysis uses qualitative methods with data collection and document analysis techniques. The purpose of this analysis is to identify relevant regulations that are implemented in an institutional management and supervision system in the Banda Sea Conservation Area.

Measurement and Analysis of Supervision Effectiveness. The method of measuring the effectiveness of supervision is carried out using a questionnaire. The measurement is based on public perception based on a questionnaire included in the in-depth interview survey material in this study. The variables used in measuring the effectiveness of supervision consist of 14 (fourteen) variables. These variables were determined based on previous research and modified by the researcher to suit the current research conditions. The measurement of the effectiveness of supervision based on public perception obtained from filling out the questionnaire to obtain variable weights using the following formula:

$$Average\ of\ variables\ (n) = \frac{Total\ respondent\ score}{Maksimum\ total\ of\ variables} \tag{1}$$

Assessment of the effectiveness of supervision using a modified formula from the supervision effectiveness model developed by Philips (2000), as follows:

$$\text{Efektifness \%} = \frac{\text{Total score of all variables}}{\text{Maximum score of all variables}} \times 100 \% \quad (2)$$

The effectiveness value for each variable is the cumulative result of public perception obtained from the survey results recap. This value becomes an indicator of supervision effectiveness in conservation areas with categories that can be seen in Table 3.

Table 3. Indicators of conservation area supervision effectiveness

No	Supervision Effectiveness	Category
1	> 75	Effective
2	50.1% - 75%	Fairly effective
3	25% - 50%	Less effective
4	< 25%	Not effective

3 Results and discussion

3.1 Monitoring conditions in the Banda Sea conservation area

Legal basis for monitoring. The implementation of marine and fisheries resource monitoring activities is mandated by Law No. 31 of 2004 concerning Fisheries, as amended by Law No. 45 of 2009. Monitoring of utilization in conservation areas is carried out by fisheries supervisors and Polsus PW3K officers appointed by the Minister of Marine Affairs and Fisheries.

Supervisory Institutions in the Banda Sea Conservation Area. Based on Regulation of the Minister of Marine Affairs and Fisheries Number 69/PERMEN-KP/2020 concerning the Organization and Work Procedures of the Technical Implementation Unit for Marine and Fisheries Resource Supervision, the implementation of supervision activities is carried out by the Technical Implementation Unit (UPT) of the Ambon PSDKP Station. The Ambon PSDKP Station has supervisory duties and roles covering the supervisory working area in the Banda Sea Conservation Area. To carry out supervisory operations in the Banda Sea conservation area, there is a supervisory work unit in Banda that carries out tasks under the control of the Ambon PSDKP Station.

Banda Sea Conservation Area Management Agency. The Banda Sea Conservation Area is managed by the Kupang National Marine Conservation Office (BKKPN) in accordance with Minister of Marine Affairs and Fisheries Regulation No. 65/PERMEN-KP/2020 in conjunction with Minister of Marine Affairs and Fisheries Regulation No. 37 of 2021 concerning the Organization and Work Procedures of Technical Implementation Units for Marine Space Management. To carry out the operational management of the Banda Marine Conservation Area, there is a KKNP

working unit in Banda that carries out tasks under the control of Kupang KKPN Office.

Surveillance Facilities and Infrastructure. Surveillance activities in the Banda Sea conservation area have been equipped with surveillance facilities in the form of administrative offices, two-wheeled vehicles, surveillance *speed boats*, surveillance location maps, GPS, cameras, diving equipment, computers, telephones, and surveillance forms. These facilities and infrastructure are in good condition and comply with the provisions of Regulation of the Director General of Marine and Fisheries Resources Surveillance No. 4 of 2022.

Human Resources for Surveillance. Fisheries Supervisors conduct surveillance activities in conservation areas for fisheries activities, while Polsus PWP3K conducts surveillance activities in conservation areas for non-fisheries activities. The Banda Marine and Fisheries Resources Supervision Unit consists of 2 personnel, namely 1 fisheries supervisor and 1 Polsus PWP3K officer. Based on Regulation of the Director General of Marine and Fisheries Resources Supervision No. 4 of 2022, the number and competence of supervision officers required to carry out supervision in the Banda Sea conservation area have met the requirements.

Implementation of operational supervision. The implementation of operational supervision activities in conservation areas refers to Regulation of the Director General of Marine and Fisheries Resources Supervision Number 4 of 2022. The supervision procedures include the type of supervision, the timing of supervision, the supervision plan, the technical aspects of supervision, and the follow-up to the results of supervision. Supervision activities in the Banda Sea Conservation Area that have been carried out include supervision patrols using *speed boats* involving stakeholders (Table 5), and the results of monitoring utilization activities in the Banda Sea Conservation Area can be seen in Table 4.

Coordination and stakeholder involvement. The SDKP Banda Supervisory Unit has carried out supervisory patrols involving stakeholders in the Banda working area. The involvement of other agencies in Surveillance Patrol activities in the Banda SDKP Surveillance Working Area can be seen in Table 5. Stakeholders involved in surveillance patrols are Wilker KKPN Banda, the Indonesian Navy Post, the Water Police Post, and the Banda VI Island Task Force. Meanwhile, the CTC Foundation and the Banda Lestari Community Group (Pokmaswas) have not yet been involved.

Findings from Monitoring. Based on the monitoring patrol reports of the Banda SDKP Monitoring Unit from 2021 to 2025, it was found that there was utilization in the conservation area that did not comply with the provisions, namely the use of fish aggregating devices (FADs). The placement of FADs in conservation areas does not comply with Article 17 paragraph (2) of Minister of Marine Affairs and Fisheries

Regulation No. 36 of 2023. The number of fish aggregating devices in the Banda Sea conservation area fluctuates constantly. The number of FADs known to exist during surveillance patrols from 2021 to 2025 can be seen in Fig 2, and the distribution map of FADs found in June 2025 can be seen in Fig 3.

Table 4. Utilization activities in the Banda Marine Conservation Area

No	Name of Activity Performer	Activity Conducted	Regulations
1	Fisherman	- Fishing - Use of fish aggregating devices	Permitted with conditions Not permitted
2	SDKP Banda Patrol Unit	Surveillance patrol	Permitted
3	Banda KKPN Task Force	Monitoring and surveillance patrol	Permitted
4	Indonesian Navy and Water Police	Patrol, guidance, and maintenance of security in the waters	Permitted
5	Motorboat drivers	Inter-island crossings	Permitted with conditions
6	Tourists	Underwater recreation	Permitted with conditions
7	Life On Board	Anchoring	Permitted with conditions
8	Other communities	Sand mining on beaches border- ing the area	Permitted with conditions
9	PT. Telkom	Underwater cable installation	Permitted with conditions
10	Transportation Agency	Construction of ship docks and port operations	Permitted with conditions
11	Researcher	Data and sample collection	Permitted with conditions
12	Passenger and cargo ships	Ship arrivals and departures from and to the port	Permitted under certain conditions

Table 5. Stakeholder Involvement in Surveillance Patrols

No	Name of Activity Performer	Involvement in Patrol		
		2022 (Patrol No.1-6)	2023 (Patrol No.1-8)	2024 (Patrol No.1-5)
1	Wilker KKPN Banda	√	√	√
2	Gusus Island VI	√	√	√
3	Maritime Police	√	√	√
4	AL Post	√	√	√
5	CTC Foundation	x	x	x
6	Pokmaswas	x	x	x

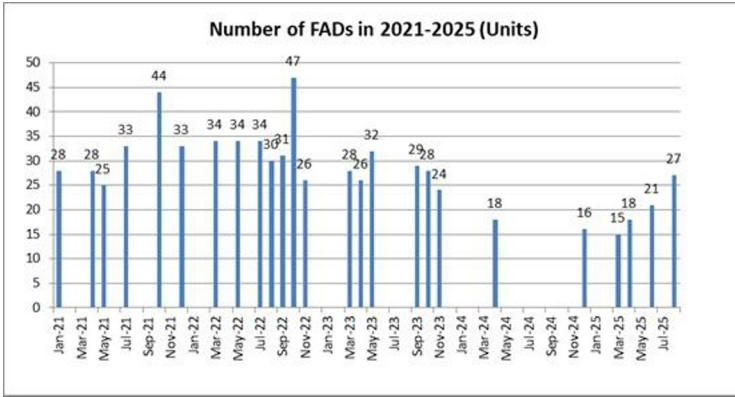


Fig. 2. Number of FADs in the Banda Sea Conservation Area from 2021 to 2025

Law enforcement and follow-up on monitoring results. Sanctions for violations of utilization in conservation areas are stipulated in Minister of Marine Affairs and Fisheries Regulation No. 26 of 2022. Violations of utilization in conservation areas in the form of fish aggregating device use are subject to sanctions in the form of warnings, government coercion, and administrative fines. Based on the findings of the monitoring results as shown in Fig. 3, the perpetrators or owners of fish aggregating devices have never been prosecuted in accordance with the provisions.



Fig. 3. Distribution of FADs in the Banda Sea Conservation Area in June 2025

3.2 Stakeholder analysis

Identification of stakeholders. The results of stakeholder identification show that stakeholders come from four elements, namely government agencies, the community, universities, and the private sector/business actors, with a total of 14 stakeholders (Table 6).

Table 6. Stakeholder identification results

No	Element	Stakeholders
1	Government	Ministry of Maritime Affairs and Fisheries, Directorate General of Marine and Coastal Management, Directorate General of Marine and Fisheries Resources Supervision, Marine and Fisheries Service of Maluku Province, Ambon Marine and Fisheries Resources Monitoring Station, Kupang National Marine Conservation Area Office, Banda Marine Police Post, Banda Naval Post
2	Community	Coral Triangle Center Foundation and Banda Lestari Community Group
3	Academy	Pattimura University and Banda Neira University
4	Private	Fisheries business operators and Fishermen

Stakeholder classification. Each stakeholder has different influence and importance values based on the respondents' perceptions. The results of the respondents' assessments show the level of influence and importance (Table 7). The higher the value, the greater the influence or importance.

Table 7. Stakeholder Influence and Importance Values

Stakeholders	Influence					Sum (πX)	Importance					Sum (πY)
	P1	P2	P3	P4	P5		K1	K2	K3	K4	K5	
KKP	3	5	3	3	5	3,8	5	5	7	7	5	5,8
Directorate General of PKRL	5	7	5	3	3	4,6	5	5	7	7	3	5,4
Directorate General of PSDKP	5	7	5	3	3	4,6	3	3	5	5	3	3,8
DKP Maluku Islands	5	4	3	3	3	3,6	3	3	2	1	3	2,4
Ambon PSDKP Station	7	5	5	5	5	5,4	4	4	7	5	3	4,6
Kupang KKP Office	7	5	7	7	5	6,2	7	5	7	7	5	6,2
Banda Marine Police	5	6	2	2	2	3,4	3	1	1	1	3	1,8
Banda Navy Post	3	3	2	2	2	2,4	3	1	1	1	3	1,8
CTC Foundation	5	5	5	5	3	4,6	5	3	3	5	5	4,2
Banda Lestari Community Group	4	3	3	3	3	3,2	4	4	5	4	3	4
Pattimura University	3	3	3	5	5	3,8	1	3	1	1	3	1,8
Banda Neira University	3	3	3	5	5	3,8	1	3	1	1	3	1,8
Business operators	3	1	1	1	1	1,4	1	1	1	1	5	1,8
Fishermen	3	3	5	5	7	4,6	3	3	5	1	3	3

Next, stakeholders are classified by comparing the scoring results with the level of importance and influence of each stakeholder in the form of an importance and influence matrix using a stakeholder grid. The categories in the matrix (Fig. 4) describe the

position and role played by each stakeholder in the management and supervision of the Banda Sea conservation area, as follows:

1. Subjects.

Stakeholders as subjects have high importance but low influence, namely the Banda Lestari Community Monitoring Group. This group is important to the success of conservation area management, but its influence is currently still low.

2. Key players

Stakeholders as key players have high importance and influence on the success of conservation area management. The Ministry of Marine Affairs and Fisheries, the Directorate General of PSDKP, the Directorate General of PKRL, Kupang KKPN Office, and the Ambon PSDKP Station play important roles through their respective duties and functions in maintaining the balance of the ecosystem in the Banda Islands waters by managing and supervising the utilization of the conservation area to achieve conservation goals or targets. Meanwhile, the CTC Foundation also has high interests and influence as a partner of the area manager.

3. Context setter/Actor

Stakeholders as Context Setters have high influence but low interest. The Maluku Provincial Government, academics, and local fishermen have high influence and can affect the success of conservation area management. The local government has authority over marine and fisheries policy up to 12 miles and can support the management of this conservation area through the creation of fishing policies, the empowerment of fishermen around the area, and the improvement of the competence and legality of community monitoring groups. Similarly, academics, although their interests are small, have an influence by increasing the understanding of the surrounding community through education.

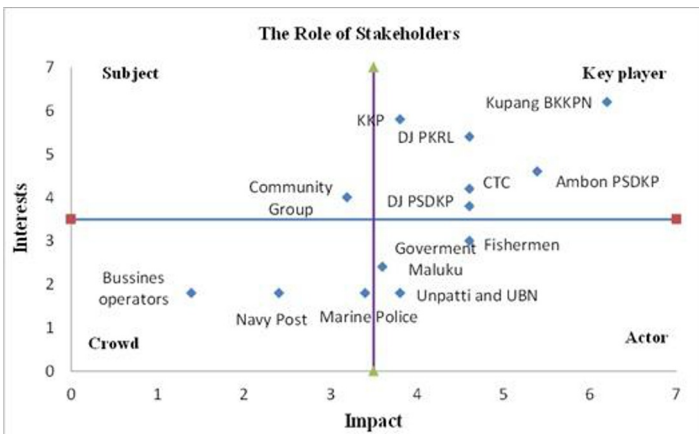


Fig. 4. Interest and influence matrix

4. Crowd

Stakeholders as a crowd have low interests and influence. The Indonesian Navy and Water Police posts have an interest in improving the security, order, and compliance

of fishermen and the surrounding community in conservation areas. They can be involved in surveillance patrol activities and provide a sense of security for the implementation of surveillance patrols. Business actors in the marine and fisheries sector can also be considered as spectators, as they have little interest in the condition of the conservation area. Stakeholders at this level need special attention so that they can influence the success of conservation objectives in the Banda Sea Conservation Area.

3.3 Analysis of regulations

The results of the collection of regulatory documents on management and monitoring in the Banda Sea Conservation Area are as shown in Table 8.

Table 8. Identification of regulatory documents

Level of Regulation	Regulatory Document and Provisions
Government Regulation (PP)	PP No. 21 of 2021 concerning Spatial Planning The basis for the implementation of spatial planning and utilization, including marine space in conservation areas PP No. 28 of 2025 concerning the Implementation of Risk-Based Business Licensing Regulates sanctions for violations of the utilization of conservation areas
Laws of the Republic of Indonesia (UU)	UU No. 32 of 2024 concerning Amendments to Law No. 5 of 1990 concerning the Conservation of Living Natural Resources and Their Ecosystems. Regulates the implementation of the conservation of living natural resources and their ecosystems requires the strengthening and harmonization of aspects of protection, preservation, and sustainable utilization, funding support in the field of conservation, law enforcement, and community participation. UU No. 27 of 2007 Jo UU No. 1 of 2014 concerning Coastal Zone and Small Islands Management The basis for the implementation of policies and management of coastal areas and small islands UU No. 31 of 2004 Jo UU No. 45 of 2009 concerning Fisheries. Basis for the implementation of fisheries policies and management, including supervisory authority and community participation in supervision of marine and fisheries affairs
Regulation of the Minister of Marine Affairs and Fisheries (Permen KP)	Permen KP No. 31 of 2020 concerning the Management of Conservation Areas Establishing the scope of conservation area management, including planning, designation, utilization, supervision, evaluation of management, and funding of conservation areas. Permen KP No. 40 of 2014 concerning Community Participation in the Management of Coastal Areas and Small Islands Regulates the role of community participation in monitoring utilization in conservation areas Permen KP No. 14 of 2016 concerning Criteria and Categories of Marine Conservation Areas for Marine Nature Tourism

Level of Regulation	Regulatory Document and Provisions
Decision of the Minister of Marine Affairs and Fisheries of the Republic of Indonesia (Kepmen KP)	<p>Establishes the Banda Sea Conservation Area as a Marine Tourism Park, so that the boundaries of utilization in the conservation area are in accordance with its provisions as a Park</p> <p>Permen KP No. 31 of 2021 concerning the Imposition of Administrative Sanctions in the Marine and Fisheries Sector</p> <p>Regulates the imposition of sanctions on business actors who violate provisions on the utilization of conservation areas</p> <p>Permen KP No. 7 of 2025 concerning the Utilization of Conservation Areas</p>
	<p>Regulates the procedures for the utilization of business and non-business activities in conservation areas</p> <p>Permen KP No. 69 of 2020 concerning the Organization and Work Procedures of the Technical Implementation Unit for the Supervision of Marine and Fisheries Resources</p> <p>Establishing the duties and authorities for the supervision of the Banda Sea and Surrounding Areas Conservation Area in Maluku Province</p>
	<p>Permen KP No. 36 of 2023 concerning the Placement of Fishing Gear and Fishing Aids in Measured Fishing Zones and State Fisheries Management Areas of the Republic of Indonesia in Inland Waters.</p> <p>Regulating fishing gear and fishing aids that may be placed in conservation areas</p>
Decision of the Director General PKRL (Kepdirjen PKRL)	<p>Kepmen KP No. 37 of 2022 concerning the Banda Sea Conservation Area and Surrounding Areas in Maluku Province</p> <p>Designating the waters in the Banda Sea and surrounding areas in Maluku Province as a National Marine Conservation Area</p> <p>Kepmen KP No. 58 of 2001 concerning Procedures for Implementing a Community Monitoring System in the Management and Utilization of Marine and Fisheries Resources</p> <p>Regulating the provisions for community involvement in the monitoring of marine and fisheries resources through a community based monitoring system</p>
Regulation of Director General PSDKP (Perdirjen PSDKP)	<p>Kepdirjen PKRL No. 64 of 2023 concerning the Management Plan for the Banda Sea and Surrounding Sea Conservation Area in Maluku Province for 2022-2042</p> <p>Basis for the preparation of management activities for the Banda Sea Conservation Area for the medium and long term</p> <p>Perdirjen PSDKP No. 5 of 2021 concerning the Development of Community-Based Marine and Fisheries Resources Supervision Groups</p> <p>Covering the duties and roles of the Director General of PSDKP in enhancing the capacity of Pokmaswas as community groups that assist in the supervision of marine and fisheries resources</p> <p>Perdirjen PSDKP No. 4 of 2022 concerning Technical Guidelines for Conservation Area Supervision</p> <p>Regulates the procedures or methods for supervision in conservation areas</p>

3.4 Measuring the effectiveness of supervision

The results of stakeholder responses to the level of importance of variables are quantified to obtain the weight of each variable as shown in Table 9. The measurement of the effectiveness of supervision of fish aggregating device (FADs) placement is based on stakeholder perceptions of each variable. The effectiveness value for each variable is a cumulative result. The results of the measurement of the effectiveness of supervision of the Banda Sea Marine Conservation Area are as follows:

$$\text{Effectiveness \%} = \frac{4,0395}{5} \times 100 \% \quad (3)$$

$$= 80,79\% \quad (4)$$

Measurement of monitoring effectiveness based on community perceptions obtained from questionnaires filled out through in-depth interviews to obtain results on the variables can be seen in Table 9. Based on the calculation results, the value of 80.79% indicates that supervision in the Banda Sea Conservation Area is categorized as "effective."

Table 9. Effectiveness of monitoring in the Banda Sea conservation area

No	Variable of Surveillance Effectiveness	Weight	Criteria	Perception score	Number of Voters	Respondent Perception per Criterion ($\sum(\text{exf})$)	Respondent Perception per Variable ($\sum g; \sum f$)	Total score perception
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
1	Establishment of the Banda Sea as a conservation area and Zoning in the Conservation	0,073	Already	5	58	290	5,000	0,3634
Process			3	0	0			
Not yet			1	0	0			
2	Institutional presence area management conservation in Banda Sea	0,068	Exists and optimal	5	58	290	5,000	0,3381
There is, but not optimally			3	0	0			
Not yet			1	0	0			
3	Institutional presence area surveillance conservation in Banda Sea	0,068	Exists and optimal	5	58	290	5,000	0,3381
There is, but not optimally			3	0	0			
Not yet			1	0	0			
4	Suitability of the number and competence of personnel supervisor	0,077	sufficient	5	10	50	3,172	0,2411
limited			3	43	129			
No personnel yet			1	5	5			
5	Operational budget	0,078	Already	5	10	50	3,241	0,2537
Not optimally			3	45	135			
Not yet			1	3	3			
6	Number and condition of facilities	0,074	The quantity is adequate	5	30	150	3,897	0,2894
limited			3	24	72			
None executed			1	4	4			
7	Procedures and methods in Area supervision Designated conservation	0,074	Exist and are implemented	5	47	235	4,586	0,3394
Exists, but not			3	10	30			

No	Variable of Surveillance Effectiveness	Weight	Criteria	Percep sion score	Numb er of Voter s	Re- spond ent Percep tion per Criterion ($\sum g: \sum f$)	Respond ent Percep tion per Variabel ($\sum g: \sum f$)	Total score persepti on
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f</i>	<i>g</i>	<i>h</i>	<i>i</i>
8	Use of technology in performing supervision	0,061	None	1	1	1	2,948	0,1798
			Yes	5	20	100		
9	Intensity of Supervision	0,068	Not Optimal	3	16	48	4,069	0,2773
			None	1	23	23		
			Conducted	5	35	175		
10	Community involvement in monitoring	0,073	Not optimal	3	19	57	3,172	0,2314
			None	1	4	4		
			Involved	5	19	110		
11	Coordination between institutions related to conservation area supervision	0,074	Involved, but not optimal	3	25	75	4,345	0,3204
			None	1	14	14		
			Coordinated and already not optimal	5	39	195		
			None	3	19	57		
12	Existence of regulations and sanctions for violations in Conservation Areas	0,066	None	1	0	0	4,828	0,3149
			Already	5	54	270		
			On process	3	3	9		
13	Law enforcement for violations of utilization in Conservation Areas	0,074	Non	1	1	1	4,069	0,3001
			Enforced in accordance	5	32	160		
			Enforced gently	3	25	75		
14	Level of public knowledge about fish aggregating devices	0,074	None	1	1	1	3,379	0,2492
			Well sosial-ized	5	20	100		
			Partially socialized	3	29	87		
			Not yet	1	9	9		
Total		1,000						4,0395

4 Conclusions

Conclusions drawn from this study there are 14 stakeholders involved in the management and supervision of the area. The management and supervision of the Banda Sea Conservation Area has a legal basis consisting of 16 laws and regulations, and the level of supervision in the Banda Sea Conservation Area is categorized as effective with an effectiveness score of 80.79%. Based on this evaluation, there are monitoring variables that need to be improved, namely the intensity of monitoring and community involvement in monitoring and the use of technology in monitoring.

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after were committed in the creation of the paper and were informed about their participation.

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