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Enhancing Marine Surveillance Governance: The Strategic Role of the Marine and Fisheries Resources Surveillance Unit in Combating Illegal Fishing in Sibolga Waters

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ABSTRACT

Indonesian fisheries governance continues to face a significant obstacle in the form of illegal, unreported, and unregulated (IUU) fishing, particularly in the Sibolga seas. This study examines the regulatory, facilitative, and dynamic roles played by the Marine and Fisheries Resources Surveillance Unit (PSDKP) in combating IUU fishing. Semi-structured interviews, document analysis, and field observations were used in a qualitative case study approach. After 14 interviews, the data were thematically categorized and reached saturation. The results demonstrate that while PSDKP uses surveillance tools like the Vessel Monitoring System (VMS) and patrols the sea, its efficacy is hampered by a lack of staff, fleets, and enforcement, where administrative consequences are more common than criminal ones. Low trust and unequal access to support continue to hinder community engagement through reporting channels and local monitoring groups (POKMASWAS). By putting up a four-pillar framework of technology, institutional capacity, community participation, and inclusive infrastructure as a model for flexible and sustainable monitoring in archipelagic contexts, this study adds to the conversation on marine governance. The results strengthen Indonesia's dedication to regional cooperation under RPOA-IUU, SDG 14.4, and the national development goal.

1. INTRODUCTION

With more than 108,000 km of coastline and a total sea area of around 6.4 million km^2, including the Exclusive Economic Zone (EEZ), Indonesia is the world's largest archipelagic nation [1]. With a sustainable fisheries potential of 12.01 million tons annually and an acceptable catch (JTB) cap of 8.6 million tons to ensure sustainability, this region has a vast amount of potential for marine resources. As evidenced by the fact that Indonesian marine product exports reached USD 5.25 billion in 2023, the marine industry not only provides the nation's food but also significantly boosts its economy [2].

Illegal, unreported, and unregulated (IUU) fishing, which includes fishing without a permit, using illegal gear, falsifying documents, and violating catch zones and limits, puts a lot of strain on this potential [3]. In addition to creating inequality in the fisheries market, this practice results in significant ecological and economic losses. Traditional fishermen find it challenging to compete with illegal vessels since they frequently sell their catch for less money. However, the primary causes of IUU fishing's inefficiency are a lack of cooperation across institutions and a lack of effective law enforcement [4].

The Ministry of Maritime Affairs and Fisheries' official data, which indicates a downward trend in the number of illegal fishing cases, reflects this reality; nevertheless, this does not imply that the decline is the result of effective law enforcement [5]. The number of cases handled throughout the last four years is summarized in the following Table 1.

Table 1. Indonesia's illegal fishing case count

Year	Case		
	Foreign Fishing Vessels (KIA)	Indonesian Fishing Vessels (KII)	Number Captured
2021	53	114	167
2022	18	79	97
2023	16	100	116
2024	9	23	23

Source: Ministry of Marine Affairs and Fisheries report, 2024

The severity of illicit fishing activities has not decreased in tandem with the decline in arrests. The decline in marine patrol operations and monitoring capacity is also linked to this number's decline. According to estimates, IUU fishing causes annual economic losses of up to USD 23 billion, or over IDR 339 trillion, demonstrating the significant effect this practice has on the country's economy [5, 6].

Illegal fishing's effects have permeated the regional financial system, lowering tax and retribution sector income, which in turn has a cascading effect on coastal regions' economic development [7]. In addition to immobilizing the local economy, this occurrence weakens the ability of regions to fund the construction of essential infrastructure and initiatives for the sustainability of fisheries. To stop this damaging trend, the government has taken decisive action by enacting a policy of sinking foreign ships found to be violating

Indonesian laws [8].

On Sumatra's west coast, Sibolga City is one of the coastal communities with a significant level of fishing activity [9]. These waters are a vital habitat for pelagic and demersal fish because of their strategic location and the abundance of coral reefs, mangroves, and seagrass beds. Sibolga is one of the main pillars of the regional maritime economy, with catch production exceeding 30.5 million kg, according to Sibolga PPN report [10].

However, because of its tremendous potential, the region is susceptible to illicit fishing, particularly by big boats that operate illegally in areas less than 12 nautical miles. This is obviously against Minister of Marine Affairs and Fisheries Regulation No. 58 of 2020 [11]. The distribution of infractions during the previous two years by fishing zone is displayed in the following data (Table 2):

Table 2. Sibolga fishing area route violations

Year	Number of Violations	Types of Violations Based on Fishing Areas (DPI)		
		< 12 mil	ZEEI	Free Sea
2022	57	7	12	38
2023	58	39	5	15

Source: Sibolga PSDKP unit report, 2023

Since the effects of these unlawful activities are extremely harmful to small fishermen, the presence of trawl nets working in restricted regions has become a severe worry for several groups [12]. Trawl net operations are challenging to halt due to inadequate field supervision and irregular patrols in the Sibolga waterways. To improve the efficacy of oversight through strategic measures, including maximizing technology like the Vessel Monitoring System (VMS), central and local governments must work together more closely [13].

Several agencies are involved in monitoring illicit fishing in the Sibolga seas, but the Ministry of Marine Affairs and Fisheries, through PSDKP Lampulo and its Sibolga implementation unit, is primarily responsible. PSDKP (Pengawasan Sumber Daya Kelautan dan Perikanan), or Marine and Fisheries Resources Surveillance Unit, is the central government body responsible for monitoring and enforcing fisheries regulations in Indonesia. The duty of overseeing and upholding the law in the maritime industry falls to this unit. The city government helps with this by providing fishermen with coaching and education. For law enforcement to be successful and long-lasting, agencies must work closely together to combat illegal fishing, particularly the central government and law enforcement agencies like Polair and the Indonesian Navy.

Illegal fishing cannot be stopped by law enforcement alone; systematic and long-term marine surveillance is required. Despite the fact that Law No. 23 of 2014 grants provincial governments the power to oversee maritime areas up to 12 miles, this function is not being carried out as well as it should due to a lack of infrastructure and resources [14]. As a result, PSDKP Sibolga primarily conducts surveillance, demonstrating that the central government's ability and plan remain crucial in the fight against illegal fishing.

Using a monitoring, controlling, and surveillance (MCS) system and patrols by patrol vessels like the HIU series, PSDKP, a division of the federal government, is responsible for overseeing and upholding the law in the maritime industry. Nonetheless, there are still a number of barriers that prevent efficient field monitoring of illicit fishing in Sibolga waters [15]. Due to disparities in strategy and policy, the primary barrier to monitoring illicit fishing in Sibolga is the poor cooperation between central agencies, such as PSDKP and Polair. Significant logistical and technological challenges also exist, such as a small fleet and staff. PSDKP only stations one patrol vessel in Sibolga, the Napoleon 036 Ship, but Polair Sibolga has nine patrol vessels but only six people [10].

Since Sibolga only has one surveillance vessel, the goal of examining two vessels daily is extremely low given the number of vessels in operation. This decreases the efficacy of supervision and creates opportunities for illicit vessels to evade detection. Table 3 shows how the funding for operational and surveillance operations was allocated and realized in the Lampulo PSDKP Performance Report for Quarter II 2024 [16].

Table 3. Performance report for Lampulo PSDKP, second quarter, 2024

Activity	Budget (Rp)	Realization (Rp)	Percentage (%)
Fleet Monitoring and Operations	16.358.298.000	5.817.208.320	41.19%
Maritime and Fisheries Sector Violation Handling	849.000.000	276.579.821	32.58%
Monitoring the Management of Marine Resources	1.001.500.000	323.413.898	32.29%
Monitoring the Management of Fisheries Resources	1.630.000.000	614.818.596	37.72%
Support for Management and Execution of Additional Technical Duties of the PSDKP Directorate General	14.930.232.000	7.082.530.294	47.44%

Source: PSDKP lampulo, 2024

The efficacy of field operations is ultimately impacted by the data, which indicates that budget absorption for core supervisory tasks is still comparatively low. This study makes use of the Lampulo PSDKP Performance Report since it captures financial and operational circumstances that also impact Sibolga PSDKP Unit oversight. A significant issue is inadequate legal enforcement, in addition to financial and technical limitations. When regulations from several authorities are inconsistent, infractions frequently result in administrative rather than criminal penalties. The deterrent effect is diminished by this indecision, which also gives the impression that legal clarity in the maritime industry has not been ensured by central control.

Given that Indonesia is the driving force behind the Southeast Asian Regional Plan of Action to Promote Responsible Fishing Practices (RPOA-IUU), this requirement

is crucial to emphasize [17]. In keeping with this regional commitment, the success of local oversight initiatives like Sibolga serves as a crucial gauge of Indonesia's involvement in international efforts to end IUU fishing. Therefore, research in this region is also globally significant, in line with the international framework that fosters inclusive and integrated maritime governance.

In terms of science, earlier research has tended to emphasize elements of national policies [18], the application of surveillance tools like the Vessel Monitoring System [19], or a community-based strategy for anti-illegal fishing participation [20]. The institutional role of central government technical implementation units, like PSDKP, is carried out at the regional level with all of its institutional and technical intricacies, but there are currently few studies that empirically examine this process. These kinds of studies are crucial for comprehending the operational and institutional constraints on the direct field implementation of marine surveillance policy.

The 2025-2029 National Medium-Term Development Plan (RPJMN), which lists eliminating IUU fishing practices and bolstering natural resource supervision as a national strategic priority, is likewise consistent with our study [21]. The Sustainable Development Goals (SDGs) are also supported by the study's focus, particularly target 14.4, which calls for the eradication of damaging fishing methods through data-driven management and sensible legislation [22]. To strengthen the design of national fisheries surveillance governance, it is crucial to have a thorough grasp of the institutional dynamics in the area.

Given the foregoing context, the purpose of this article is to examine how the central government, via PSDKP, is preventing illicit fishing in Sibolga City's waters. The author of this paper aims to identify the institutional, technological, and structural barriers PSDKP faces in fulfilling its supervisory function in the areas and develop solutions for enhancing integrative, adaptive, and sustainable maritime surveillance governance. It is anticipated that these findings will aid in the creation of sensible fishing regulations, particularly in coastal regions with complex surveillance.

2. LITERATURE REVIEW

2.1 The government's role in monitoring marine resources

A key component of creating a just, sustainable, and flexible governance structure that can respond to global issues is the government's responsibility in managing marine resources. The three primary roles of government are as a facilitator, a dynamicator, and a regulator [23]. As a regulator, the government can create laws, regulations, and standards that apply to all parties involved in the marine and fisheries industry [24]. By promoting active community involvement and launching social change via empowerment, education, and training, the government acts as a dynamic actor [25]. As a facilitator, the government is in charge of establishing the institutional framework, infrastructure, and facilities necessary to assist the accomplishment of maritime development objectives [26].

Given the size of the sea area and the difficulty of its oversight, the central government's participation is crucial in an archipelagic nation like Indonesia. The Ministry of Marine Affairs and Fisheries (KKP), a strategic agency of the federal government, is tasked with making sure that the use of marine resources adheres to sustainability standards. As a technical implementing entity, the Marine and Fisheries Resources supervisory entity (PSDKP) is directly involved in putting supervisory policies into practice. The government also acts as a development agent, ensuring that policies are implemented in a way that truly affects the social and economic well-being of coastal communities [27].

The effectiveness of marine resource supervision can be examined using [23] three primary governmental tasks. Table 4 description of these roles that follows demonstrating how each function is represented in the framework of fisheries supervision.

Table 4. The role of government

Role of Government	Main Functions	Putting Marine Surveillance into Practice
Regulator	Establishing laws and standards	Fishing zone designation and trawl prohibition
Dynamicator	Organizing and advancing society	Purchasing patrol boats and providing incentives for fishing equipment
Facilitator	Establishing a favorable atmosphere for the execution of development	Supplying support for ecologically appropriate fishing equipment and facilities such fishing ports and fish auction sites (TPI)

It is evident from the above chart that the three responsibilities work in tandem to determine the effectiveness of maritime surveillance governance. However, the difficulties of bureaucratic politics, scarce human resources, and unequal incentive distribution at the implementation level have not been specifically taken into account by Sahri et al. [23]'s theory of government responsibilities. In reality, agency relationships, regional political backing, and budgetary frameworks all have a significant impact on how well the three responsibilities are implemented. As a result, to interpret the execution of the roles of regulator, dynamicator, and facilitator, this study will also take into account the local administrative context.

2.2 Concept of illegal, unreported, and unregulated (IUU) fishing

The sustainability of coastal economies and marine ecosystems is seriously threatened by IUU fishing. Illegal, unreported, and unregulated fishing are the three damaging behaviors that make up IUU fishing [28]. Falsifying vessel documentation, using restricted fishing gear, violating fishing zones, and fishing by foreign vessels without authorization are all considered forms of IUU fishing in Indonesia [29].

The Ministry of Marine Affairs and Fisheries [5] estimates that IUU fishing causes economic losses of up to USD 23 billion per year, demonstrating the significant impact on state revenue and coastal communities' income. In addition, IUU fishing leads to inequity in the fisheries market and harms fish stocks, seagrass beds, and coral reefs. According to Bellanger [30], IUU fishing falls under the category of transnational crimes that call for a multi-sector approach and a cross-country response. IUU fishing contributes to 11-26 million tons of illegal fishing captures annually [18, 31].

This harms many developing nations, particularly those with weak marine monitoring capabilities. Table 5 presents a classification of infringements and their corresponding

implications, providing a clearer understanding of the various types of infractions that fall under the umbrella of IUU fishing and their respective impacts.

Table 5. Categorization according to violation type and effect

Types of IUU Fishing	Case	Ecological Impact	Economic Impact
Illegal Fishing	Unauthorized arrest	Fish population declines and habitat degradation	State revenue loss from taxes and non-tax sources (PNBP)
Unreported Fishing	Not reporting catch	Inaccurate stock management data	The inefficiency of the quota policy
Unregulated Fishing	Foreign vessels operating on the high seas without authorization	Marine biodiversity disturbance	Inequality of price competition

The foundation for developing focused mitigation solutions is an understanding of this classification. Supervisory organizations like PSDKP can create interventions that are in line with the features of dangers in the field by comprehending the types and effects.

2.3 Maritime surveillance strategy in archipelagic countries

As an archipelagic nation, Indonesia has significant difficulties in keeping an eye on its extensive and enormous marine areas [32]. As a result, the Monitoring, Control, and Surveillance (MCS) system is the method employed in marine surveillance. Three components make up this system: surveillance (direct maritime surveillance), control (administrative control and licensing), and monitoring (fishing activity monitoring). This method heavily relies on technologies like the Automatic Identification System (AIS) and Vessel Monitoring System (VMS) [33].

Orofino et al. [13] demonstrated how the application of VMS technology can enhance transparency in fishermen's reporting and enhance early detection of illicit activity. However, institutional preparedness, human resource capability, and digital infrastructure are critical to this system's success. While the center is in charge of oversight within the Exclusive Economic Zone (EEZ), Law No. 23 of 2014 gives the provincial government the authority to regulate the sea up to 12 miles [14]. But in reality, the central government still bears the responsibility of oversight because many provinces lack the technical and logistical capabilities [34].

Frameworks like the United Nations Convention on the Law of the Sea (UNCLOS) and the Regional Plan of Action to Promote Responsible Fishing Practices (RPOA-IUU) are crucial resources for enhancing international and regional collaboration in cross-border surveillance [35]. Given that Indonesia has direct borders with several nations that also have high rates of fisheries breaches, this is extremely pertinent.

2.4 Institutional approach in maritime law enforcement

Strong, well-coordinated institutions are needed for maritime industry supervision and law enforcement against infractions. The Ministry of Marine Affairs and Fisheries' PSDKP Unit is in charge of conducting supervisory duties in the areas, which include managing legal administration, operating surveillance vessels, and looking into incidents of violations. However, poor cross-sector cooperation and a lack of operational resources can undermine the efficacy of supervision.

PSDKP's stance differs from that of other agencies like Polair and TNI AL, which frequently impedes integrated legal action [36]. The government must actively participate in fleet procurement, boost human resource capacity, and standardize agency regulations to provide effective supervision [37]. The ecological and social justice features of fisheries monitoring should be taken into consideration in addition to the formal institutional aspects [38]. Due to their limited access to safe reporting methods and monitoring equipment, small-scale fishermen are frequently in a more vulnerable position. This disparity could erode public confidence in monitoring organizations and increase the divide between large-scale and small-scale fishing communities.

This study adopts a conceptual framework that positions the central government's role (regulator, dynamic, facilitator) as the cornerstone of the marine surveillance system. It is based on the theory of the role of government and the institutional approach that has been explored. Operational support, including money, personnel, fleet, and technology use, fulfills this function. The involvement of coastal communities and cross-agency coordination has a significant impact on how well supervision is implemented in the regions. The effectiveness of technical units like PSDKP in monitoring illicit, unreported, and unregulated (IUU) fishing operations is influenced by each of these factors [39]. The relationships between the components of the conceptual framework employed in this study are depicted in the following Figure 1.

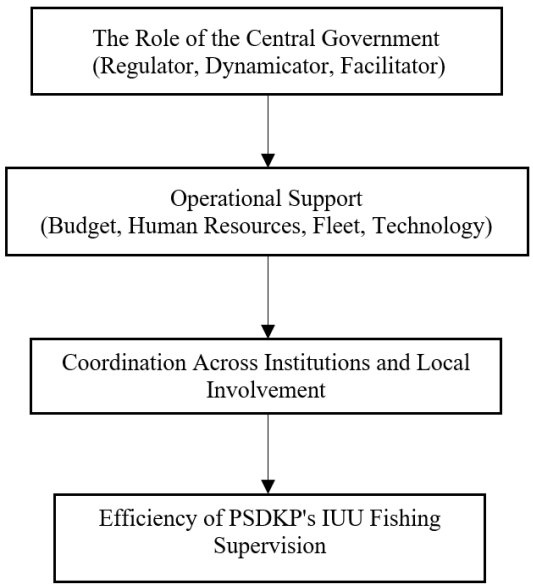

Figure 1. Conceptual framework

In addition to providing a theoretical road map for thought, this conceptual framework also forms the foundation for gathering research tools and conducting data analysis. The goal of this research is to give a comprehensive understanding of the dynamics of PSDKP institutions at the local level by determining the relationship between the role of the central government, operational assistance, institutional coordination, and the efficacy of oversight. Every component of this framework will serve as a guide for creating a methodical approach that is pertinent to the subject.

3. METHODS

3.1 Design and methodology of the research

This research uses an inherent case study design and a qualitative approach [40], to comprehend the socio-institutional dynamics of the federal government's use of PSDKP to combat IUU fishing in Sibolga City. Because it enables in-depth examination of intricate institutional procedures within a particular local setting, the case study technique was used.

3.2 Location, time, and focus of research

Between January and March 2025, the study was carried out at Sibolga City, North Sumatra Province. Sibolga was chosen because of its active PSDKP surveillance unit and high intensity of catch fisheries. (i) evaluating PSDKP's institutional role as a regulator, facilitator, and dynamic actor; (ii) assessing the effectiveness of operational support (fleet, personnel, budget, and technology); (iii) analyzing coordination patterns with related agencies like TNI AL and Polair; and (iv) determining the results of surveillance activities in addressing IUU fishing were the main objectives of the study.

3.3 Informants and sampling strategy

Informants were selected purposively based on direct involvement or expertise in fisheries surveillance [41]. Among them were academic observers, PSDKP technical officers, Navy personnel, Marine Affairs and Fisheries Department representatives, and community-based supervisors (see Table 6).

Table 6. General profile of research informants

No.	Informant Category	Amount	Description
1	PSDKP Technical Officer/Employee	4	Directly involved in patrol and regulatory activities
2	Indonesian Navy Officer	3	Coordinating enforcement at sea
3	North Sumatra Province Marine Affairs and Fisheries Department	2	Coordination of licensing policies and fisheries data
4	Community Representatives	3	Local supervisors actively engaged in coastal monitoring
5	Scholar/Marine observer	2	Providing evaluative and independent perspectives

In total, 14 interviews were conducted, transcribed, and analyzed. Data saturation was reached at the 12th interview, when no new substantive themes emerged; two additional interviews confirmed stability of findings [42].

3.4 Types of data and data collection techniques

Data were gathered through three complementary techniques [43]: (i) semi-structured interviews with key stakeholders; (ii) direct observation of patrol and coordination activities; and (iii) document analysis of policy papers, performance reports, and case records. Triangulation across these sources enhanced validity. The supporting table that follows shows how data types, sources, and collection methods relate to one another (see Table 7).

Table 7. Types of data and data collection techniques

Types of Data	Primary Source	Collection Techniques
Institutional structure and role	PSDKP documents, structural officials	Documentation study, interviews
Surveillance patrol activity	Field Officer	Observation, interview
Logistics and operational support	Head of unit, financial report	Documentation study, interviews
Inter-agency coordination	TNI AL, Polair, DKP	Observation, interview
Perception of institutional effectiveness	Society	Observation, interview

In order to better maintain the validity of the information and more accurately account for the study findings, this table shows how the employment of different data gathering methodologies attempts to ensure data quality through a triangulation process.

3.5 Techniques for data analysis and validation

Thematic analysis was employed to identify and interpret patterns across the data [44]. The process included: (i) transcription of interviews and field notes; (ii) open coding to capture early notions; (iii) axial coding to connect categories and subthemes; and (iv) selective coding to refine overarching themes in line with the conceptual framework. Iterative note writing was used to establish uniformity throughout the analysis. To improve validity, methodologies and sources were triangulated, informant input was solicited via member checks, and an audit trail of analytical stages was kept.

4. RESULTS

In-depth interviews, participant observations, and documentation studies on PSDKP's implementation of IUU fishing supervision in Sibolga City were used to gather field data for this study. The analysis was conducted thematically by referencing the central government's institutional role as a regulator, facilitator, and dynamic, as well as the efficiency of the technical implementing units' implementation of supervision in the regions [23].

4.1 Regulating role

The PSDKP maintains laws in Sibolga waterways using technology-based surveillance, direct field supervision, and sanctions. The Fisheries Vessel Monitoring System (SPKP),

when paired with the Vessel Monitoring System (VMS), allows for real-time tracking of fishing vessels. SPKP (Sistem Pemantauan Kapal Perikanan), which serves as Indonesia's Fisheries Vessel Monitoring System (VMS), represents the primary regulatory instrument employed by PSDKP in monitoring fishing activities. However, coverage remains poor since many small-scale vessels are not fitted with the devices, and the number of supervisory officers is limited, resulting in decreased monitoring capability.

Field supervision takes place at multiple levels, including document verification at ports before departure, monitoring during fish landing, and direct patrols at sea. In practice, patrol frequency is minimal because Sibolga has just one surveillance vessel and a small number of active personnel. This situation limits the extent of observation due to the area's high fishing intensity. The Monitoring, Control, and Surveillance (MCS) structure used by PSDKP in Sibolga is summarized in Table 8 below.

Table 8. PSDKP concept for fisheries supervision (MCS framework)

MCS Dimensions	MCS Components	Unlicensed Vessel Detection Capability	Capacity to Capture Ships	Cost
Before fishing	Supervision of ship departure	No	Yes	Low
While Fishing	Patrol boat patrol	Medium	Yes	High
	Air Patrol	High	No	Medium
	VMS	No	No	Low/Medium
During Landing	Supervision of Ship Arrivals	No	Yes	Low

Source: FAO fishery manager's guidebook, 2024

This circumstance indicates that there has not been sufficient operational capability to support the surveillance plan. The low frequency and scope of patrols create a haven for violators due to the large coverage area and high level of vulnerability to illegal fishing activities. Therefore, for surveillance to function efficiently and sustainably, institutional strengthening such as raising budget allocations, updating the fleet, and adding trained human resources (HR) is required in addition to better technical tactics.

Third, administrative sanctions like warnings and fines are given precedence over criminal law enforcement when it comes to enforcing infractions. This has come under fire since it is thought to have no deterrent impact, particularly when it comes to repeat offenders or major infractions such as using trawls, which are illegal fishing gear. The information below lists instances of illicit fishing that have taken place recently, along with the kinds of penalties that the appropriate authorities have imposed.

In addition to technology and patrols, PSDKP levies penalties on violators. According to records from 2021 to 2024, the bulk of offenses concerned the usage of banned trawl nets. The sanctions imposed were mostly administrative, such as fines or written warnings. The specifics of the infractions and punishments levied are shown below (see Table 9).

Finally, PSDKP conducts coordination with Polairud, TNI AL, and the provincial/district Marine and Fisheries Department. Coordination mainly takes the form of case transfers and occasional joint patrols. Although these efforts show the existence of institutional collaboration, the mechanism for systematic follow-up remains limited, so coordination is still focused on operational rather than evaluative aspects.

Table 9. Violations of illegal fishing in Sibolga, 2021-2024

Year	Vessel	Sanction Types	Types of Violations
2021	KM. Hasil Rezeki Bersama (GT 70)	Administrative Fines	
2022	KM. AB (GT 33)	Administrative Fines	
2024	KM Cendrawasih (GT 5)	Written warning/reprimand	Using Trawl
2024	KM Jaya (GT 7)	Written warning/reprimand	
2024	KM Naurajaya (GT 5)	Written warning/reprimand	

Source: PSDKP Sibolga, 2024

4.2 The government's dynamist role

In addition to regulatory tasks, PSDKP promotes community engagement in surveillance efforts. Several procedures have been devised to incorporate local players, such as public reporting channels and community-based monitoring groups (POKMASWAS). POKMASWAS (Kelompok Masyarakat Pengawas), or Community-Based Fisheries Surveillance Groups, are established in Sibolga to involve local fishers in monitoring and reporting illegal fishing practices.

Public reporting services are provided on a variety of platforms, including the national complaint website (lapor.go.id), WhatsApp, e-mail, and direct office submissions. These channels are intended to allow for faster reporting of potential infractions while also protecting reporters' confidentiality. Despite the range of possibilities, use remains low since community members rarely submit problems directly through these channels.

PSDKP also promotes the formation of POKMASWAS, which serve as early warning organizations in coastal areas. In Sibolga, three groups are legally registered and active, as shown below (see Table 10).

Table 10. Sibolga City POKMASWAS list

No.	Name of the Group	Location	Number of Decrees (SK)
1	Bina Samudera	Bangau Street No.24, South Sibolga District	Date: December 23, 2024; Decree of the Head of Marine Affairs and Fisheries Service Number: 188.4/SK.987/XII/2024
2	Sambas Bahari	Jati Street No.104, Sibolga	On November 4, 2019, the Head of Marine Affairs and Fisheries Service issued Decree Number: 188.4/SK.511/XI/2019.
3	Mina Sepakat	Sibolga City	Head of the Fisheries and Marine Affairs Office 188.4/SK.221/V/2023 is the decree. Date: May 22, 2023

Source: North Sumatra Province marine affairs and fisheries service, 2025

These three groups represent the government's efforts to expand surveillance coverage to locations that are not easily accessible by official patrols. They also serve as local middlemen, connecting fishermen with the supervisory agency. Overall, while institutional tools for public participation exist, actual community engagement in Sibolga remains low, as seen by the small number of current reports and the restricted visibility of POKMASWAS operations.

4.3 The central government's facilitating role

The federal government, through PSDKP, also contributes to the development of a more sustainable fisheries system by giving operational support and infrastructure to fishing villages. This responsibility is evident in three major areas: improving surveillance fleets and technology, assisting with fishing equipment and manufacturing facilities, and developing fisheries infrastructure.

Fleet improvement is accomplished by providing patrol boats and utilizing Vessel Monitoring System (VMS) technology to track vessel movements in real time. These procedures are intended to improve the detection of infractions, particularly those happening in restricted fishing zones. However, the number of patrol boats and field workers remains restricted, limiting the scope of monitoring activities.

The provision of environmentally friendly fishing gear and facilities, such as cold storage units, helps to boost production. The goal is to lessen reliance on damaging instruments like trawl nets while increasing the quality of fish capture. Access to these facilities, however, varies by local fishing community.

In addition, the government helps to construct fisheries infrastructure, such as fish auction sites (TPI) and fishing ports. TPI (Tempat Pelelangan Ikan), or Fish Auction Place, functions as both an economic hub for fish distribution and a regulatory mechanism to improve transparency in fisheries governance. These facilities serve commercial and regulatory purposes by boosting catch distribution efficiency, keeping the cold chain intact, and increasing transparency in the local fisheries market. The application of these facilitation roles is described below (see Table 11).

Table 11. Synopsis of PSDKP facilitators' function in Sibolga City fisheries supervision and empowerment

Facilitation Aspect	Key Findings
Fleet Enhancement and Surveillance Technology	Patrol boat and VMS availability is still constrained by field operations and human resources
Assistance with environmentally appropriate fishing gear	Support for ecologically appropriate fishing gear that can be used in place of trawls; distribution is not even
Facilitation of production facilities (cold storage, etc.)	Although there exist facilities for production and cold storage, access is not equally dispersed
Development of fisheries infrastructure (fish auction places and ports)	Fish ports and auction houses facilitate trade transparency and logistical efficiency

These facilitation efforts show that beyond law enforcement, the government also supports the operational and economic activities of fishermen. The combination of patrol vessels, production assistance, and fisheries infrastructure reflects the government's attempt to integrate surveillance with empowerment initiatives in Sibolga.

5. DISCUSSION

The data show that PSDKP in Sibolga City has three primary functions: regulator, dynamic actor, and facilitator, but each position has persistent constraints. As a regulator, PSDKP uses SPKP and VMS as technological advancements for vessel surveillance and coordinates field patrols with other agencies. However, coverage is inadequate, and law enforcement is hampered because consequences are primarily administrative rather than criminal. This disparity between legal standards and field implementation reflects an enforcement deficit that reduces deterrence, a pattern also seen in the Philippines and Malaysia, where vessel monitoring systems exist but are hampered by resource constraints and limited follow-up [45].

PSDKP, as a dynamic actor, aims to engage the public through complaint channels and community-based monitoring groups (POKMASWAS). Sibolga has three technically created organizations; however, there are few current reports. Limited trust and the absence of systematic responses to complaints hinder community participation, rendering it symbolic rather than substantive. This condition is consistent with the New Public Governance paradigm, which emphasizes responsibility and responsiveness in citizen-state collaboration [46]. Timor-Leste experiences demonstrate that community monitoring is only effective when consistent government support and feedback mechanisms are in place [47].

The facilitative role is carried out by providing patrol vessels, alternate fishing gear, cold storage, and fish auction sites (TPI). These techniques are designed to prevent damaging fishing practices and improve post-harvest handling. Nonetheless, access to support and infrastructure remains varied among fishing groups, limiting the overall effectiveness of facilitation initiatives. Similar patterns of selective facilitation have been observed in coastal governance initiatives in Southeast Asia, where advantages tend to concentrate among some individuals while excluding others [48].

The synthesis of these findings is illustrated in Figure 2, which portrays PSDKP's threefold role and the challenges that accompany each.

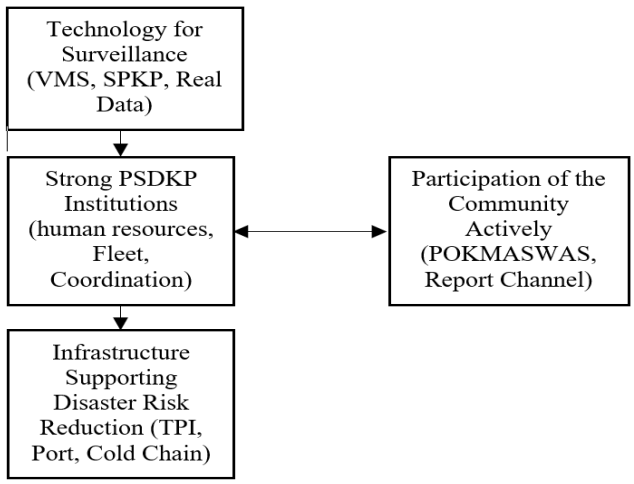

Figure 2. PSDKP integrative model for Sibolga City coastal waters monitoring

To complement this visualization, the overall implementation and challenges of PSDKP functions are summarized in Table 12.

This synthesis implies that Sibolga's surveillance governance cannot be based primarily on legislative instruments or technology, but must also include institutional capability, participatory methods, and inclusive infrastructure. In comparison, these findings are consistent with the issues faced by other archipelagic governments in Southeast Asia, particularly the Philippines and Timor Leste, where enforcement is dispersed and community engagement

struggles to progress beyond symbolic forms. Strengthening collaboration under the Regional Plan of Action to Promote Responsible Fishing Practices, Including Combating IUU Fishing (RPOA-IUU), becomes critical, since coordinated patrols, intelligence sharing, and harmonized sanctions can give answers that go beyond state boundaries.

Table 12. Overview of PSDKP's functions in Sibolga fisheries surveillance

Function	Implementation	Key Challenges
Regulator	VMS/SPKP application, patrols, sanctioning	Limited fleets, small number of officers, weak enforcement dominated by administrative sanctions
Dynamic actor	Public reporting (lapor.go.id, WhatsApp, email), establishment of 3 POKMASWAS groups	Low community trust, symbolic participation, limited follow-up of reports
Facilitator	Provision of patrol boats, alternative fishing gear, cold storage, fish auction places	Unequal access to facilities, selective distribution, inadequate long-term support

Based on this analysis, the paper adds to the literature on marine governance by suggesting a four-pillar framework technology, institutional capacity, community participation, and inclusive infrastructure as a model for adaptive and sustainable fisheries surveillance. These pillars not only address Indonesia's local governance issues, but also reaffirm pledges to SDG 14.4 and regional cooperation against IUU fishing.

6. CONCLUSIONS

According to the study's findings, the Marine and Fisheries Resources Surveillance Unit (PSDKP) in Sibolga performs three primary functions: facilitator, dynamic actor, and regulator. However, each of these functions is constantly constrained. Inadequate fleets and manpower limit regulatory efforts through SPKP/VMS and patrols, while administrative methods continue to dominate sanctions with little deterrent impact. Low trust and symbolic engagement hinder the dynamic role of involving communities through POKMASWAS groups and complaint channels. Although it shows official support, the facilitative role, which includes the provision of patrol boats, fishing gear, cold storage, and auction facilities, is still not uniformly dispersed.

The report synthesizes these results and suggests a four-pillar architecture for sustainable and adaptable surveillance: inclusive infrastructure, institutional capacity, technology, and community participation. This framework supports regional initiatives against IUU fishing under the RPOA-IUU as well as Indonesia's reform of fisheries governance. By guaranteeing that resource exploitation continues to be permitted, disclosed, and controlled, it also strengthens commitments to SDG14.4.

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REFERENCES

[1] Andréfouët, S., Paul, M., Farhan, A.R. (2022). Indonesia's 13558 islands: A new census from space and a first step towards a one map for small islands policy. Marine Policy, 135: 104848. https://doi.org/10.1016/j.marpol.2021.104848

[2] Wang, S., Lu, B., Yin, K. (2021). Financial development, productivity, and high-quality development of the marine economy. Marine Policy, 130: 104553. https://doi.org/10.1016/j.marpol.2021.104553

[3] Stefanus, A.A., Vervaele, J.A. (2021). Fishy business: Regulatory and enforcement challenges of transnational organised IUU fishing crimes. Trends in Organized Crime, 24(4): 581-604. https://doi.org/10.1007/s12117-021-09425-y

[4] Kuemlangan, B., Amidjogbe, E.R., Nakamura, J., Tomassi, A., Hupperts, R., Bojang, B., Amador, T. (2023). Enforcement approaches against illegal fishing in national fisheries legislation. Marine Policy, 149: 105514. https://doi.org/10.1016/j.marpol.2023.105514

[5] KKP. (2024). Laporan kinerja kementerian kelautan dan perikanan tahun 2024. https://kkp.go.id/publikasi/akuntabilitas-kinerja/pelaporan-kinerja.html, accessed on Jul. 03, 2025.

[6] Khan, A.M., Jiang, M.G., Yang, X.Q., Apriliani, I.M., Purba, N.P., Wiryawan, B., Taurusman, A.A., Pasaribu, B. (2024). Illegal fishing threatens the sustainability of future tuna commodities in Indonesia. Marine Policy, 159: 105936. https://doi.org/10.1016/j.marpol.2023.105936

[7] Witbooi, E., Ali, K.D., Santosa, M.A., Hurley, G., Husein, Y., Maharaj, S., Okafor-Yarwood, I., Quiroz, I.A., Salas, O. (2020). Organized crime in the fisheries sector threatens a sustainable ocean economy. Nature, 588(7836): 48-56. https://doi.org/10.1038/s41586-020-2913-5

[8] Ikaningtyas, N., Kurniaty, R. (2018). The implementation of vessel-sinking policy as an effort to protect Indonesian fishery resources and territorial waters. IOP Conference Series: Earth and Environmental Science, 137(1): 012038. https://doi.org/10.1088/1755-1315/137/1/012038

[9] Hidayati, D., Widayatun, W. (2021). The dynamic of fishermen's income and the influencing factors on the west and east coasts of Sumatra Island. IOP Conference Series: Earth and Environmental Science, 934(1): 012030. https://doi.org/10.1088/1755-1315/934/1/012030

[10] PPN Sibolga. (2023). Laporan statistik pelabuhan perikanan nusantara sibolga tahun 2023. https://kkp.go.id/download-pdf-akuntabilitas-kinerja/akuntabilitas-kinerja-pelaporan-kinerja-laporan-statistik-ppn-sibolga-tahun-2023.pdf, accessed on Jul. 03, 2025.

[11] KKP. (2020). Permen KKP nomor 58 tahun 2020. https://jdih.kkp.go.id/Homedev/DetailPeraturan/891, accessed on Jul. 03, 2025.

[12] Mackay, M., Hardesty, B.D., Wilcox, C. (2020). The intersection between illegal fishing, crimes at sea, and social well-being. Frontiers in Marine Science, 7: 589000. https://doi.org/10.3389/fmars.2020.589000
[13] Orofino, S., McDonald, G., Mayorga, J., Costello, C., Bradley, D. (2023). Opportunities and challenges for improving fisheries management through greater transparency in vessel tracking. ICES Journal of Marine Science, 80(4): 675-689. https://doi.org/10.1093/icesjms/fsad008
[14] Undang-Undang, R.I. (2014). Undang-undang nomor 23 tahun 2014 tentang pemerintahan daerah. https://peraturan.bpk.go.id/Details/38685/uu-no-23-tahun-2014, accessed on Jul. 03, 2025.
[15] Purnomohadi, S.H. (2003). Indonesia BOBLME national report. BOBLME Report, pp. 145. http://www.boblme.org/documentRepository/Nat_Indonesia.pdf, accessed on Jul. 03, 2025.
[16] PPSDKP Lampulo. (2024). Laporan kinerja pangkalan pengawasan sumber daya kelautan dan perikanan lampulo triwulan II tahun 2024. https://kkp.go.id/download-pdf-akuntabilitas-kinerja/akuntabilitas-kinerja-pelaporan-kinerja-laporan-kinerja-pangkalan-psdkp-lampulo-triwulan-ii-tahun-2024.pdf, accessed on Jul. 03, 2025.
[17] Williams, M.J. (2013). Will new multilateral arrangements help southeast asian states solve illegal fishing? Contemporary Southeast Asia, 35(2): 258-283. http://www.jstor.org/stable/43281253.
[18] Agnew, D.J., Pearce, J., Pramod, G., Peatman, T., Watson, R., Beddington, J.R., Pitcher, T.J. (2009). Estimating the worldwide extent of illegal fishing. PLoS ONE, 4(2): e4570. https://doi.org/10.1371/journal.pone.0004570
[19] Margarit, G., Barba Milanés, J.A., Tabasco, A. (2009). Operational ship monitoring system based on synthetic aperture radar processing. Remote Sensing, 1(3): 375-392. https://doi.org/10.3390/rs1030375
[20] Purcell, S.W., Pomeroy, R.S. (2015). Driving small-scale fisheries in developing countries. Frontiers in Marine Science, 2: 44. https://doi.org/10.3389/fmars.2015.00044
[21] RPJMN 2025-2029. (2025). Peraturan presiden (perpres) nomor 12 tahun 2025 mengenai rencana pembangunan jangka menengah nasional (RPJM nasional) tahun 2025-2029. https://peraturan.bpk.go.id/Details/314638/perpres-no-12-tahun-2025, accessed on Jul. 03, 2025.
[22] Hák, T., Janoušková, S., Moldan, B. (2016). Sustainable development goals: A need for relevant indicators. Ecological Indicators, 60: 565-573. https://doi.org/10.1016/j.ecolind.2015.08.003
[23] Sahri, A., Mustika, P.L.K., Dewanto, H.Y., Murk, A.J. (2020). A critical review of marine mammal governance and protection in Indonesia. Marine Policy, 117: 103893. https://doi.org/10.1016/j.marpol.2020.103893
[24] Garren, M., Lewis, F., Sanchez, L., Spina, D., Brett, A. (2021). How performance standards could support innovation and technology-compatible fisheries management frameworks in the US. Marine Policy, 131: 104631. https://doi.org/10.1016/j.marpol.2021.104631
[25] Dushkova, D., Ivlieva, O. (2024). Empowering communities to act for a change: A review of the community empowerment programs towards sustainability and resilience. Sustainability, 16(19): 8700. https://doi.org/10.3390/su16198700
[26] Guerreiro, J. (2021). The blue growth challenge to maritime governance. Frontiers in Marine Science, 8: 681546. https://doi.org/10.3389/fmars.2021.681546
[27] Andrews, N., Bennett, N.J., Le Billon, P., Green, S.J., Cisneros-Montemayor, A.M., Amongin, S., Gray, N.J., Sumaila, U.R. (2021). Oil, fisheries and coastal communities: A review of impacts on the environment, livelihoods, space and governance. Energy Research & Social Science, 75: 102009. https://doi.org/10.1016/j.erss.2021.102009
[28] Beseng, M. (2021). The nature and scope of illegal, unreported, and unregulated fishing and fisheries crime in Cameroon: Implications for maritime security. African Security, 14(3): 262-285. https://doi.org/10.1080/19392206.2021.1982241
[29] Fujii, I., Okochi, Y., Kawamura, H. (2021). Promoting cooperation of monitoring, control, and surveillance of IUU fishing in the Asia-Pacific. Sustainability, 13(18): 10231. https://doi.org/10.3390/su131810231
[30] Bellanger, M. (2017). Modelling institutional arrangements and bio-economic impacts of catch share management systems: Application to the bay of biscay sole fishery. Doctoral Dissertation, Université de Bretagne Occidentale-Brest. https://theses.hal.science/tel-01595956v2.
[31] Mozumder, M.M.H., Uddin, M.M., Schneider, P., Deb, D., Hasan, M., Saif, S.B., Nur, A.A.U. (2023). Governance of illegal, unreported, and unregulated (IUU) fishing in Bangladesh: Status, challenges, and potentials. Frontiers in Marine Science, 10: 1150213. https://doi.org/10.3389/fmars.2023.1150213
[32] Mangubhai, S., Erdmann, M.V., Wilson, J.R., Huffard, C.L., Ballamu, F., Hidayat, N.I., Hitipeuw, C., Lazuardi, M.E., Muhajir, Pada, D., Purba, G., Rotinsulu, C., Rumetna, L., Sumolang, K., Wen, W. (2012). Papuan bird's head seascape: Emerging threats and challenges in the global center of marine biodiversity. Marine Pollution Bulletin, 64(11): 2279-2295. https://doi.org/10.1016/j.marpolbul.2012.07.024
[33] Shepperson, J.L., Hintzen, N.T., Szostek, C.L., Bell, E., Murray, L.G., Kaiser, M.J. (2018). A comparison of VMS and AIS data: The effect of data coverage and vessel position recording frequency on estimates of fishing footprints. ICES Journal of Marine Science, 75(3): 988-998. https://doi.org/10.1093/icesjms/fsx230
[34] Cronkleton, P., Pulhin, J.M., Saigal, S. (2012). Co-management in community forestry: How the partial devolution of management rights creates challenges for forest communities. Conservation and Society, 10(2): 91-102. https://doi.org/10.4103/0972-4923.97481
[35] Cremers, K., Bouvet, M., Wright, G., Rochette, J. (2021). Options for strengthening monitoring, control and surveillance of human activities in the southeast atlantic region. STRONG High Seas Project.
[36] Afriansyah, A., Solihin, A., Bilqis, A., Prasetya, J.H. (2021). Collaborative surveillance best practices and lesson learned against IUU fishing. Phase 2 (ATSEA-2) Project. https://atsea-program.com/.
[37] Nguyen, H.P. (2020). Human resource management of logistics in Vietnam: Status and policy solutions. Human Resource Management, International Journal of Innovation, Creativity and Change, 11(3): 569-583.

[38] Quimby, B., Levine, A. (2018). Participation, power, and equity: Examining three key social dimensions of fisheries comanagement. Sustainability, 10(9): 3324. https://doi.org/10.3390/su10093324
[39] Ismail, K., Kusasi, F., Fitriana, R. (2018). Fishers'welfare in Natuna waters post IUU fishing policy implementation. Indonesia Marine Fellows Program-MFP, Pasarminggu. https://doi.org/10.13140/RG.2.2.34508.77444
[40] Baxter, P., Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. The Qualitative Report, 13(4): 544-559. http://www.nova.edu/ssss/QR/QR13-4/baxter.pdf.
[41] Katikiro, R.E., Mahenge, J.J. (2016). Fishers' perceptions of the recurrence of dynamite-fishing practices on the coast of Tanzania. Frontiers in Marine Science, 3: 233. https://doi.org/10.3389/fmars.2016.00233
[42] Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., Burroughs, H., Jinks, C. (2018). Saturation in qualitative research: Exploring its conceptualization and operationalization. Quality & Quantity, 52(4): 1893-1907. https://doi.org/10.1007/s11135-017-0574-8
[43] Moser, A., Korstjens, I. (2018). Series: Practical guidance to qualitative research. Part 3: Sampling, data collection and analysis. European Journal of General Practice, 24(1): 9-18. https://doi.org/10.1080/13814788.2017.1375091
[44] Castleberry, A., Nolen, A. (2018). Thematic analysis of qualitative research data: Is it as easy as it sounds? Currents in Pharmacy Teaching and Learning, 10(6): 807-815. https://doi.org/10.1016/j.cptl.2018.03.019
[45] Fabinyi, M., Belton, B., Dressler, W.H., Knudsen, M., Adhuri, D.S., Aziz, A.A., Akber, M.A., Kittitornkool, J., Kongkaew, C., Marschke, M., Pido, M., Stacey, N., Steenbergen, D.J., Vandergeest, P. (2022). Coastal transitions: Small-scale fisheries, livelihoods, and maritime zone developments in Southeast Asia. Journal of Rural Studies, 91: 184-194. https://doi.org/10.1016/j.jrurstud.2022.02.006
[46] Lapsley, I. (2022). Whatever happened to new public management? Financial Accountability and Management, 38(4): 471-482. https://doi.org/10.1111/faam.12346
[47] Clarke, N.E., Dyer, C.E., Amaral, S., Tan, G., Vaz Nery, S. (2021). Improving uptake and sustainability of sanitation interventions in Timor-Leste: A case study. International Journal of Environmental Research and Public Health, 18(3): 1013. https://doi.org/10.3390/ijerph18031013
[48] Rüland, J. (2023). The long shadow of the developmental state: Energy infrastructure and environmental sustainability in Southeast Asia. Third World Quarterly, 44(6): 1269-1287. https://doi.org/10.1080/01436597.2023.2178890