

Strengthening Illegal Fishing Monitoring through the Implementation of Vessel Monitoring System

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Abstract— Indonesia's fisheries industry, an important pillar of the national economy, faces major challenges due to illegal fishing practices. Illegal, Unreported, and Unregulated (IUU) fishing is a global problem that threatens marine ecosystems and sustainable fisheries. FAO reports that Indonesia experiences an annual loss of approximately IDR 30 trillion due to IUU fishing, not including potential losses such as decreased output of the fishing industry and socio-economic impacts for fishers. To address this issue, the implementation of Vessel Monitoring System (VMS) is crucial to improve the protection of Indonesia's fishing industry. VMS, as a geospatial maritime strategy, utilises data and technology to effectively monitor and manage fisheries resources. By accurately mapping fishery areas, identifying vessel movement patterns, and analysing data, VMS facilitates compliance monitoring, area violation detection, and fishing quota management. This system not only supports sustainable fishing but also combats illegal practices, enabling faster enforcement actions. This article uses a qualitative approach with a literature review method to explore the strengthening of illegal fishing monitoring through the implementation of VMS. The study evaluates the effectiveness of VMS in detecting and preventing illegal fishing, reviews policy and regulatory support, and analyses the role of stakeholders. The findings emphasise the importance of VMS for real-time monitoring and law enforcement, contributing to the sustainability of marine resources and the well-being of fishing communities.

Keywords—Illegal fishing; Vessel Monitoring System; Sustainable Fisheries

I. INTRODUCTION

Indonesia's fisheries industry, an important pillar of the national economy, is currently facing severe challenges due to illegal fishing practices. Illegal, unreported and unregulated fishing, often referred to as IUU, has become a global issue that threatens marine ecosystems and sustainable fisheries (Agnew et al. in Longépé et al., 2018). This practice not only threatens the sustainability of maritime natural resources, but also causes economic losses. FAO reported that Indonesia loses an estimated IDR 30 trillion annually due to IUU fisheries, but this figure does not include the potential value lost, such as the decline of the fishing industry, unemployment, and other social consequences experienced by fishers (FAO, 2023).

Industri perikanan Indonesia, yang merupakan salah satu pilar penting dalam perekonomian nasional, saat ini sedang menghadapi tantangan berat akibat praktik penangkapan ikan ilegal. Penangkapan ikan yang ilegal, tidak dilaporkan, dan tidak diatur, yang sering disebut sebagai IUU, telah menjadi isu global yang mengancam ekosistem laut dan perikanan berkelanjutan (Agnew et al. dalam Longépé et al., 2018). Praktik ini tidak hanya mengancam keberlanjutan sumber daya alam laut, tetapi juga menyebabkan kerugian ekonomi. FAO melaporkan bahwa Indonesia kehilangan sekitar Rp30 triliun per tahun akibat perikanan IUU, tetapi angka ini belum termasuk potensi nilai yang hilang, seperti menurunnya industri perikanan, pengangguran, dan konsekuensi sosial lainnya yang dialami nelayan (FAO, 2023).

II. RESEARCH METHODS

In writing this article, a qualitative approach with a literature review method is applied to explore in depth and comprehensively the efforts to strengthen the monitoring of illegal fishing through the implementation of the Vessel Monitoring System. The qualitative approach allows researchers to understand this phenomenon from various perspectives based on data and information available in the literature as well as official data sources from the Ministry of Marine Affairs and Fisheries (MMAF) (Sugiono, 2016). The Ministry of Marine Affairs and Fisheries (MMAF) is an Indonesian government agency responsible for the management of marine and fisheries resources. By using the literature review method and analysing data from the MMAF, this article seeks to identify the basic theories and concepts underlying the application of VMS in monitoring illegal fishing. In addition, the article also examines various case studies and experiences of VMS implementation in various countries, including the successes and challenges faced (Ishtiaq, 2019).

This approach allows researchers to evaluate the effectiveness of VMS in detecting and preventing illegal fishing based on data and findings from the literature and MPA reports. The analysis of policies and regulations that support the implementation of VMS in Indonesia as well as the role of stakeholders in its implementation is also the main focus. Through this qualitative approach, this article is expected to provide evidence-based policy recommendations to strengthen monitoring and law enforcement against illegal fishing in Indonesian waters. Thus, this research is expected to make a significant contribution in understanding and addressing the problem of illegal fishing as well as supporting efforts to conserve marine resources and the welfare of fishing communities.

III. DISCUSSION

The fishing industry is one that has been running for centuries and is now growing rapidly and is considered an important element of economic growth in various countries such as Indonesia (Sinaga et al., 2018). Illegal, unreported and unregulated (IUU) fishing is a growing threat to sustainable fisheries and economies around the world. To address this issue, various monitoring, control, and surveillance efforts have been conducted at the national, regional, and international levels (Fujii et al., 2021). Currently, the fishing industry in Indonesia is facing some important challenges and changes. Indonesia, as the world's second largest producer of marine catch after China, is experiencing a decline in fish stocks. Recent data from Indonesia's Ministry of Marine Affairs and Fisheries shows that fish stocks are expected to total 12 million metric tonnes by 2022, a decrease of nearly 4% from the previous estimate in 2017. Furthermore, 53% of Indonesia's 11 fisheries management areas are now considered fully exploited, up from 44% in 2017. This suggests the need for stricter monitoring (Mongabay, 2023). The government has been working for several years to improve fish stocks, particularly under the leadership of former minister of marine affairs and fisheries Susi Pudjiastuti, who held the post from 2014 to 2019. These efforts included keeping illegal foreign fishing vessels out of Indonesian waters. However, challenges continue and require comprehensive and sustained efforts to ensure the sustainability and well-being of the fishing industry in Indonesia (Eco Business, 2022).

The importance of this industry is not only for the local economy but also for the ecological balance of the ocean. Strategies required include the regulation of sustainable fisheries, environmentally friendly practices, quota management, and protection of marine habitats. In addition, strong legal oversight and public education are needed to prevent illegal fishing and raise awareness about conservation. By integrating economic, ecological and social aspects, Indonesia can create a sustainable and environmentally friendly fishing industry (Dryden et al., 2008). The fishing industry plays an important role in the economy, contributing to GDP and creating jobs. Maritime Spatial Planning (MSP) is essential to integrate various maritime activities, including supporting fisheries sustainability. Effective management of fish resources, as well as policies that prevent overfishing, are crucial to maintain the balance of marine ecosystems. The industry also faces adaptation and modernisation challenges, including the use of technology in fishing and trade, to respond to changing environmental and market conditions (Salas-Leiton et al., 2022). The sector not only contributes to national GDP, but also provides employment for millions of people. A healthy fishing industry can promote stable economic growth, increase exports, and reduce poverty levels.

In an environmental context, protection of the fishing industry is important to ensure the sustainability of marine resources. Studies conducted (Carmine et al., 2020) highlight the importance of accountability in the high seas fishing industry. Their findings, which reveal dramatic declines in the abundance of many open ocean species due to fishing, demonstrate the significant impact this industry has on marine biodiversity. Furthermore, the study reveals how approximately 2,482 fishing

vessels on the high seas can be linked to 1,120 corporate entities, highlighting that it is these companies, not just countries, that are responsible for the majority of fishing in the global oceans. These findings are important because they offer a new perspective on who should be responsible for the exploitation of marine resources. By identifying that the top 100 corporations represented 36% of fishing effort on the high seas in 2018, the study demonstrates a significant concentration of fishing effort. This opens up opportunities to regulate the industry more effectively and ensure that fishing practices are not only sustainable but also adhere to responsible environmental and social standards. From a resource management perspective, these findings make it possible to develop more responsible and sustainable strategies. Understanding the structure and dynamics of corporations involved in high seas fishing is an important step towards protecting marine biodiversity and ensuring that fisheries resources remain sustainable for future generations.

Illegal fishing causes many economic, environmental and social losses. The Indonesian government, through the Ministry of Maritime Affairs and Fisheries (MMAF), has made various efforts to address the problem of illegal fishing. One such effort is to strengthen surveillance by using advanced technological devices known as Vessel Monitoring System (VMS) or Fishery Vessel Monitoring System (SPKP). This application is very important to support the preservation of fisheries resources so that they can be utilised sustainably for the welfare of the community. The implementation of VMS in Indonesia involves three parties: the government (in this case the Directorate General of PSDKP and KKP) which acts as an organiser by providing systems without transmitters and satellite services, business actors or owners of fishing vessels as users, and companies that provide VMS transmitters and satellite services (Kadariusman et al., 2019).

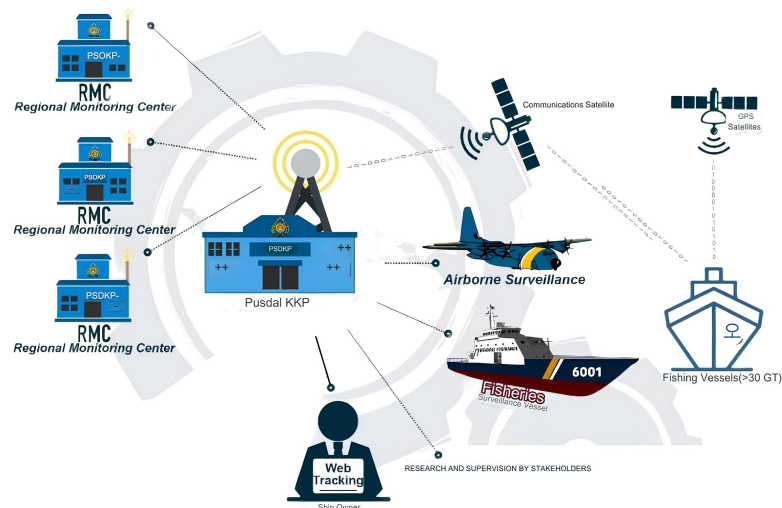


Figure 1. Use of Vessel Monitoring System at the Ministry of Marine Affairs and Fisheries

Source: Extracted from Task Force 115

The use of Vessel Monitoring System (VMS) is an important step in monitoring fishing vessel activity and tackling illegal fishing. VMS uses GPS technology to track the position and movement of vessels in real-time, which supports more effective fisheries policy making and conservation of marine resources (Doherty et al., 2021). VMS allows fisheries authorities to identify violations of restricted zones and detect illegal fishing practices quickly. Since 2003, the Directorate General of PSDKP has implemented VMS for fishery vessels by establishing a VMS monitoring and operational system, as well as installing transmitters on fishery vessels of a certain size, making it possible to know the presence and movement of fishery vessels and to identify their activities. Regulation of the Minister of Maritime Affairs and Fisheries No. 42/PERMEN-KP/2015 requires fishing vessels of more than 30 GT operating in the State Fisheries Management Area of the Republic of Indonesia (WPPNRI) and on the high seas to install VMS transmitters (Directorate General of PSDKP, 2017).

Table 1. Number of Sea Fishing Vessels > 30 GT by Province (Unit)

NUMBER OF MARINE CAPTURE FISHERIES VESSELS - MOTORISED VESSELS > 30 GT	2019	2020	2021	2022
TOTAL (UNIT)	4313	5393	6426	6643
PULAU SUMATERA	1075	911	891	1165
ACEH	358	71	101	504
BENGKULU	11	10	3	5
JAMBI		1	5	5
KEPULAUAN BANGKA BELITUNG	5	10	11	10
KEPULAUAN RIAU	231	305	291	272
LAMPUNG		1	2	2
RIAU	9	16	27	28
SUMATERA BARAT	137	94	98	
SUMATERA SELATAN	16	13	9	12
SUMATERA UTARA	308	390	344	327
JAVA ISLAND	2536	3512	4514	4568
BANTEN	18	38	52	47
DAERAH ISTIMEWA YOGYAKARTA	1	1	3	3
DKI JAKARTA	1419	2108	2955	1918
JAWA BARAT	277	349	407	373
JAWA TENGAH	718	873	929	2077
JAWA TIMUR	103	143	168	150
BALI ISLAND - SOUTH-EAST DEUSA	338	542	592	493
BALI	338	541	579	491
NUSA TENGGARA BARAT		1	13	
NUSA TENGGARA TIMUR				2
KALIMANTAN ISLAND	74	89	80	86
KALIMANTAN BARAT	70	82	74	78
KALIMANTAN SELATAN	2	1		
KALIMANTAN TENGAH				
KALIMANTAN TIMUR	2	5	5	7
KALIMANTAN UTARA		1	1	1

SULAWESI ISLAND	170	241	257	220
GORONTALO	23	49	50	52
SULAWESI BARAT				
SULAWESI SELATAN	3	1	3	1
SULAWESI TENGAH	3	2	3	1
SULAWESI TENGGARA	42	23	16	2
SULAWESI UTARA	99	166	185	164
MALUKU-PAPUA ISLAND	120	98	92	111
MALUKU	11	3	6	7
MALUKU UTARA	44	35	35	53
PAPUA	31	33	29	31
PAPUA BARAT	34	27	22	20

Source: Ministry of Marine Affairs and Fisheries

The table shows data on the number of marine fishing vessels of more than 30 Gross Tonnage (GT) in Indonesia by province from 2019 to 2022. There was a significant increase in the total number of vessels from 4,313 units in 2019 to 6,643 units in 2022. This increase reflects the growth of Indonesia's fisheries fleet and increased fisheries activity in various regions. On the island of Sumatra, some provinces such as Aceh and Riau Islands showed a significant increase. For example, Aceh saw an increase from 358 units in 2019 to 504 units in 2022. On the island of Java, the largest increases occurred, especially in DKI Jakarta and Central Java. DKI Jakarta increased from 1,419 units in 2019 to 1,918 units in 2022, while Central Java increased from 718 units to 2,077 units in the same period. On the island of Bali and Nusa Tenggara, Bali also showed a significant increase, especially from 2019 to 2021, although it decreased in 2022. Kalimantan Island shows stability in the number of vessels with a slight increase in some provinces such as West Kalimantan and East Kalimantan. On Sulawesi Island, some provinces such as Gorontalo and North Sulawesi show an increase in the number of vessels, although some other provinces experience fluctuations. In the Maluku and Papua regions, the data shows slight fluctuations with a relatively stable number of vessels.

This increase in the number of vessels emphasises the importance of using Vessel Monitoring System (VMS) for monitoring and surveillance of fishing vessel activities. With the increase in the number of vessels, VMS becomes an important tool to detect and prevent illegal fishing practices, monitor vessel movements in real-time, and ensure vessels are operating in accordance with applicable regulations. VMS implementation helps fisheries authorities identify violations in restricted zones, detect illegal fishing activities, and support more effective fisheries policy-making. With VMS in place, authorities can quickly respond to violations and ensure the sustainability of marine resources.

Research conducted by Li et al. (2021) in the South China Sea found that VMS is effective in reducing illegal fishing by monitoring vessel movement patterns and fishing activities using satellite data. The use of VMS allows the identification of areas experiencing overfishing and the taking of fish stock protection measures. VMS data is used to classify vessel activities and detect non-compliance with fisheries regulations, indicating the presence of IUU fishing activities (Utama et al., 2021). In addition, VMS supports zone-based fisheries management and seascape-scale conservation, enabling identification of overfished areas and protection of important habitats. With VMS data analysis, spatially and temporally explicit patterns of fishing activity can be identified, contributing to sustainable ecosystem management (Sales Henriques et al., 2023).

Real-time monitoring by VMS enables rapid response to illegal fishing and supports inter-agency coordination in law enforcement. Information from VMS also supports more effective policy-making and planning of marine resource conservation strategies (Marzuki et al., 2018). Thus, VMS is an important tool that provides valuable insights into fishing activities and enables faster and more effective prevention and response to illegal fishing. The integration of geospatial technologies and multilateral

cooperation can strengthen efforts to conserve and sustainably manage marine resources. International co-operation, strengthened regulations, and the use of advanced technologies such as VMS and surveillance satellites are essential in a comprehensive strategy to tackle illegal fishing (Witt & Godley, 2007; Fisabilillah et al., 2023; Jones et al., 2023).

IV. CONCLUSION

The fisheries industry in Indonesia plays an important role in the national economy and the balance of marine ecosystems. Facing the threat of Illegal, Unreported, and Unregulated (IUU) Fishing, the application of Vessel Monitoring System (VMS) technology is key in detecting and cracking down on illegal activities. VMS helps maintain the sustainability of fisheries resources through effective surveillance and swift law enforcement. International collaboration, strengthened regulations, and the use of advanced technology are needed to tackle illegal fishing. The sustainability of the fishing industry also depends on good resource management, education, and engagement of all parties, including government, industry, and local communities.

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