

# Implementation of Collision Regulations (Colreg) to Avoid the Danger of Collisions in Narrow Shipping Channels on the KM. Pangrango

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## **Abstract.**

*Narrow channels in Indonesian waters pose significant collision risks for passenger ships like KM. Pangrango due to dense local traffic and limited maneuverability. This study aims to analyze COLREG Rules 5-9 implementation and identify implementation constraints during watchkeeping. Qualitative descriptive approach employed purposive sampling of two navigation officers (Second and Third Officer) as key informants. Data collected via direct observation, semi-structured interviews, and document analysis, validated through triangulation. Findings reveal generally compliant COLREG application through visual-radar monitoring, safe speed adjustments, risk assessments, evasive maneuvers, and right-side channel positioning. However, suboptimal consistency in comprehensive surveillance, bridge coordination, and early decisive actions persists due to fluctuating alertness amid unpredictable fishing vessels and buoys. Practically, enhanced bridge resource management training is recommended. Future research should examine multi-vessel comparisons.*

**Keywords:** Collision Avoidance, Colreg Compliance, Narrow Channels, Navigation Safety and Passenger Vessels.

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## **I. INTRODUCTION**

Indonesia has vast waters as an archipelagic nation with high shipping activity, making sea transportation the main link between islands for passengers, goods, and fisheries. As stated, "Indonesia's territory, which is an archipelagic nation, has a very large water area with a high level of shipping activity." This condition makes narrow shipping lanes around ports prone to collisions between vessels, triggered by limited space, traffic density from various types of vessels such as passenger, merchant, fishing, and fixed objects such as fish aggregating devices (FADs).

Narrow waterways require careful navigation due to the differences in size, speed, and maneuverability of vessels operating simultaneously, increasing the risk of collision with serious impacts on life and the environment. According to COLREG, "COLREG regulates various important provisions, including Rule 5 observation, Rule 6 safe speed, Rule 7 collision risk assessment, Rule 8 avoidance measures, and Rule 9 navigation procedures in narrow waterways." The International Regulations for Preventing Collisions at Sea (COLREG) 1972 is the main reference for prevention through these regulations.

Although COLREG is integrated into Law Number 66 of 2024 concerning Shipping, collision accidents still often occur due to failures in implementation, such as lack of observation and hesitation in maneuvering, as in the case of the collision of Mellinda with Rezeki Penuh 1 in the Gelasa Strait. The KNKT report stated, "the lack of observation around the ship by the crew of RP 1 Rezeki Penuh 1, and also the Captain of RP 1 was not in the wheelhouse at the time of the collision." Human factors are dominant in incidents in crowded waters near ports.

On the KM. Pangrango, a passenger ship operating in narrow waterways such as the Banda Neira-Yos Soedarso Ambon route, observations revealed a congested situation with fish aggregating devices (FADs), fishing vessels, and fishing boats moving erratically, requiring increased observation and coordination by the watch officer and helmsman. It was found that, "Around the ship were many FADs, fishing vessels, and fishing boats moving erratically and not all of them understood the shipping lane regulations." The implementation of COLREG has not been optimal due to low supervision consistency and external challenges.

This study aims to analyze the application of COLREG (Rule 5-9) to avoid collisions in narrow channels on the KM. Pangrango and identify related obstacles. The problem formulation includes, "How is the application of COLREG in avoiding the risk of collision in narrow shipping channels on the KM.

Pangrango ship?". The urgency arises from the high risk in Indonesian waters where human error is dominant, so that the evaluation of crucial practices for passenger shipping safety; novelty in the Maluku focus with triangulation, different from Kendek et al. (2021) or Wicaksono et al. (2025).

## II. METHOD

This study uses a descriptive qualitative approach that aims to describe in depth the implementation of Collision Regulations (COLREG) Rules 5-9 to avoid the risk of collision in narrow shipping lanes on the KM Pangrango, in accordance with the characteristics of qualitative methods that emphasize intensive observation of natural phenomena without variable manipulation. This approach was chosen because it allows for a holistic exploration of the navigational behavior of watch officers and helmsmen, as explained by Sugiyono (2021) that qualitative research is suitable for exploratory and interpretative studies in the field. Furthermore, Creswell and Poth (2021) emphasized that descriptive qualitative designs are effective for analyzing social processes such as maritime regulatory compliance through narratives and direct observation.

The research instruments included semi-structured interviews with second and third officers as key informants, participant observation during duty, and a literature review of COLREG regulations and related documents. Triangulation techniques were applied to cross-validate primary data (interviews and observations) with secondary data (KNKT reports and shipping laws). Data analysis followed the Miles and Huberman model adapted by Emzir (2021), including data reduction by sorting relevant indicators based on Rules 5-9, presentation in a narrative triangulation table, and inductive inference to identify compliance and constraints. Sudaryono (2022) added that this type of qualitative analysis ensures credibility through continuous verification.

The study population comprised all navigational officers and helmsmen of the KM Pangrango, who were responsible for guard duty on the narrow channel between Banda Neira and Yos Soedarso, Ambon. The purposive sampling consisted of two individuals (second officer and third officer) due to their direct expertise in COLREG implementation. This selection aligns with Sugiyono's (2021) qualitative sampling principle, which emphasizes informative informants for in-depth data saturation. Creswell and Poth (2021) recommend a small but representative sample in a single case study like this to focus on the depth of the maritime context.

The research procedure began with an initial literature review for the COLREG theoretical framework, followed by direct observation during sea practice on the KM Pangrango from July 8, 2024 to July 22, 2025. In-depth interviews were conducted in November 2024, secondary data collection from ship documents and regulations, and then step-by-step analysis to conclusions through triangulation verification. This process follows Emzir's (2021) systematic flow for qualitative analysis, ensuring iteration between data collection and interpretation. Sudaryono (2022) emphasizes this immersive approach for validity in field research.

## III. RESULTS AND DISCUSSION

### Data Presentation

#### 1. Observation Results

Based on the author's observations during 1 year and 2 weeks of sea practice (Prala), the author obtained results related to the application of COLREG when ships sail in narrow shipping lanes. Observations were made by the author on board the KM. Pangrango ship based on the route and schedule of the KM. Pangrango voyage 20 in 2024, namely when the ship sailed from Banda Neira Port to Yos Soedarso Port, Ambon, and vice versa. Observations were focused on when ships entered and exited the narrow shipping lane approaching Yos Soedarso Port, Ambon and the entry and exit channels of Banda Neira Port, which are known as waters with fairly dense local shipping activities.

The KM schedule and route. 20th Pangrango voyage in 2024:

RUTE DAN JADWAL KM. PANGRANGO  
VOYAGE 20.2024

VOYAGE 20.2024							
NO	PELABUHAN	ETA			ETD		
		Hari	Tanggal	Jam	Hari	Tanggal	Jam
1	Ambon	Kamis	7-Nov-24	20:00	Jum'at	8-Nov-24	14:00
2	Banda	Sabtu	9-Nov-24	04:00	Sabtu	9-Nov-24	16:00
3	Ambon	Minggu	10-Nov-24	06:00	Minggu	10-Nov-24	20:00
4	Namrole	Senin	11-Nov-24	06:00	Senin	11-Nov-24	08:00
5	Ambon	Senin	11-Nov-24	18:00	Senin	11-Nov-24	23:59
6	Banda	Selasa	12-Nov-24	14:00	Selasa	12-Nov-24	17:00
7	Saumlaki	Rabu	13-Nov-24	22:00	Kamis	14-Nov-24	03:00
8	Banda	Jum'at	15-Nov-24	08:00	Jum'at	15-Nov-24	11:00
9	Ambon	Sabtu	16-Nov-24	01:00	Sabtu	16-Nov-24	20:00
10	Banda	Minggu	17-Nov-24	10:00	Minggu	17-Nov-24	13:00
11	Saumlaki	Senin	18-Nov-24	18:00	Senin	18-Nov-24	23:00
12	Banda	Rabu	20-Nov-24	04:00	Rabu	20-Nov-24	07:00
13	Ambon	Rabu	20-Nov-24	21:00			

**Notes:**  
 - Kepada Nakhoda agar menyampaikan Laporan Perjalanan kapal (Bagian Deck), tabel silang penumpang & muatan dan kendala operasional pada setiap akhir voyage kepada:  
 • Divisi Usaha Penumpang Non Komersial ( [divisi\\_upnk@pelni.co.id](mailto:divisi_upnk@pelni.co.id) )  
 • Divisi Usaha Barang Non Komersial ( [divy\\_pkb@pelni.co.id](mailto:divy_pkb@pelni.co.id) & [passenger&freight\\_center@pelni.co.id](mailto:passenger&freight_center@pelni.co.id) )  
 • Divisi Operasi Angkutan Penumpang ( [divisioperasikapal@pelni.co.id](mailto:divisioperasikapal@pelni.co.id) )  
 • Pusat Reservasi ( [reservasi@pelni.co.id](mailto:reservasi@pelni.co.id) )

**Fig. 1. 20th KM Voyage Schedule. Pangrango**

Source: Researcher Documentation (2024)

During the observation, the author, as the cadet on watch, second mate, and helmsman, was on bridge watch duty. The mate on watch was assisted by the helmsman on watch, who was in charge of steering the ship according to the mate's orders. Weather conditions at the time were relatively good with fairly clear visibility, but the area around the ship was quite crowded due to the presence of fish aggregating devices (FADs), several fishing vessels, and fishing boats operating around the shipping lane. This limited the ship's maneuverability and arguably increased the risk of collision, especially with the movements of fishing vessels, which were often irregular and difficult to predict.



**Fig 2. Helmsman on the Bridge**

Based on the author's observations, the author found several COLREG rules related to this situation, namely, rule 5 on look-out, rule 6 on safe speed, rule 7 on risk of collision, rule 8 on actions to avoid collision, and rule 9 on narrow shipping lanes. Regarding the obstacles encountered by the author during observations, there were several obstacles, especially obstacles originating from external factors. Many fishing vessels and fishing boats that do not understand or apply COLREG rules make their movements difficult to predict. In addition, there are also fish aggregating devices (FADs) around the shipping lanes that narrow the space for vessels to move and require a higher level of vigilance when on watch.

**Tab. 1. Observation Results**

Observation Indicators	Procedures Based on COLREG	Appropriate /Not Appropriate	Observation Results Description
Implementation of COLREG in narrow shipping lanes on KM. Pangrango	The watch team carries out continuous observation (Rule 5), maintains a safe speed (Rule 6), carries out a collision risk assessment (Rule 7), takes action to avoid the risk of collision (Rule 8), and sails in accordance with narrow channel	In accordance	The officer on watch and the helmsman conducted visual observations using RADAR and AIS. The vessel's speed was reduced to accommodate the crowded conditions surrounding the vessel due to the presence of fish aggregating devices (FADs), fishing vessels, and fishing boats in the channel.

regulations (Rule 9).		
In rule 8, avoidance action is carried out by changing course and/or speed in a way that is understood by the other vessel and does not create a new danger.	In accordance	When a fishing vessel passes near a shipping lane and its movement is uncertain, the officer on watch can give a slow but clear command to change course, accompanied by an adjustment of the vessel's speed so that the vessel can pass the object at a safe distance without leaving the channel.
Ensure the ship remains as close as possible to the right side of the shipping lane and provide warnings when necessary.	In accordance	Vessels are kept to the right of the channel. In some situations, sound signals are also used to signal surrounding vessels that are too close to the channel and not responding clearly to maneuvers.
Anticipating external obstacles that could disrupt shipping safety	It is not in accordance with	Obstacles found were the large number of fishing vessels and traditional boats that did not fully implement COLREG and the large number of fish aggregating devices (FADs) around shipping lanes, thus restricting the space for ships to maneuver.
Navigation decisions are made in a timely manner and prioritize safety.	In accordance	The officer on watch makes decisions carefully and calmly with attention to the safety of the ship, crew and passengers.

Source: Researcher Data (2025)

## 2. Interview Results

In the interview results, the author took data obtained from interviews conducted by the author with



the crew on board the ship where the author chose 2 sources. The first source is the second officer as the watch mate and the mate who is responsible for all navigational equipment, understands the Collision Regulation rules well, and how to navigate properly and correctly. Next, the third officer as the second source as the safety mate on board the ship. The author chose these two sources because they are the ship's crew who are directly involved in navigation activities, maneuvers on the bridge, and have knowledge of

**Fig. 3. Interview with second officer**

COLREG regulations. In addition, the author is also a watch cadet together with the second officer and third officer on the bridge. The following is a description of the results of the interviews conducted by the researcher as follows:

Interview results

Interview Blueprint

Time	: November 12, 2024 (Watch hours 00:00 – 04:00) and November 15, 2024 to November 16, 2024 (Watch hours 12:00 – 16:00)
Interview Location	: On board the KM. Pangrango ship
Purpose of Interview	: Knowing How to Apply Collision Regulations in Narrow Shipping Lanes on Ships
Respondents	: Second Officer and Third Officer KM. Pangrango

**Tab. 1. Interview Results**

No	Question	Respondents' Answers	
		Second Officer	Third Officer
1	How is the implementation when a ship enters a narrow shipping channel?	When entering narrow channels, increased visual observation and the use of RADAR and AIS are necessary. Vessels must remain on a safe course and coordination with the bridge must be strengthened due to the presence of numerous fishing vessels and fish aggregating devices (FADs) around the channel.	Assisting with visual observation and ensuring proper communication on the bridge so that any changes in the situation can be responded to promptly.
2	What are the considerations in determining the speed and position of a ship in a narrow shipping lane?	Speeds are reduced depending on traffic density, channel width, and the presence of fishing vessels. Vessels are kept as close as possible to the right side of the channel to avoid conflicts with other vessels.	Low speed makes it easier to control the vessel and maintains safety during maneuvers in confined spaces.
3	How to assess the risk of collision with a fishing vessel?	Risk is assessed through changes in bearing, distance, and radar and visual monitoring. Any uncertainty is considered a potential hazard that needs to be addressed.	Pay attention to the direction and distance of fishing boats that often move irregularly and immediately coordinate them.
4	What actions should be taken when a fishing vessel is near a shipping lane?	Reduce speed or change course gradually and clearly so that it is easy for other vessels to understand without leaving the channel.	Maneuvers are carried out in a stable and coordinated manner, and using sound signals when necessary.
5	What obstacles are faced and how to overcome these obstacles?	The main obstacles are fishing boats and fish aggregating devices (FADs), which restrict movement. These are addressed by increasing vigilance and reducing speed.	The irregular movement of small vessels is a challenge, so coordination and readiness to maneuver at all times are required.

Source: Researcher Data (2025)

Based on the results of interviews with the Second Officer and Third Officer, it can be understood that the implementation of COLREG in the narrow shipping lane on KM. Pangrango has basically referred to the provisions of Rule 5 regarding the obligation to conduct observations, Rule 6 regarding safe speed, Rule 7 regarding collision risk assessment, Rule 8 regarding avoidance measures, and Rule 9 regarding procedures for sailing in narrow channels. Supervision is carried out through direct observation supported by radar and AIS, speed adjustments are applied according to traffic conditions and channel characteristics, and avoidance maneuvers are carried out in a planned manner when there are fishing vessels around the lane. In addition, coordination and communication on the bridge also support the smooth running of the watch service so that the ship remains within the safe channel limits.

However, several issues still require attention, particularly in dealing with the erratic movements of fishing vessels and the presence of obstacles such as fish aggregating devices (FADs) that limit vessel movement. Consistency in the division of observation tasks, optimal use of navigational equipment, and regular evaluation of watchkeeping procedures in narrow channels are needed to ensure that the implementation of COLREG is not merely a formality, but is truly preventative and responsive to field conditions. Overall, the implementation of COLREG on the KM. Pangrango is considered good, but still requires strengthening aspects of discipline, ongoing vigilance, and operational evaluation to ensure maximum and sustainable shipping safety.

## Data analysis

In this study, the author conducted a data analysis based on direct observation and interviews with the ship's crew, namely the second officer and helmsman who carried out watch duty on the bridge of the KM. Pangrango ship while sailing from Banda Neira to Yos Soedarso Port, Ambon. The main focus of this analysis is aimed at the implementation of the Collision Regulation (COLREG), especially rules 5, 6, 7, 8, and 9 in narrow shipping lanes and conditions around the ship that are dense with fishing boats, traditional boats, and fish aggregating devices (FADs) around the shipping lane.

The selection of these two informants was based on their respective roles and responsibilities in the implementation of the Collision Regulation (COLREG), specifically observation, speed regulation, collision risk assessment, and avoidance measures while on watch in narrow shipping lanes. Through this source triangulation, the author compared the suitability of the information provided by the two informants with the aim of determining the consistency of understanding and implementation of COLREG on board ships. The results of this triangulation are expected to provide a more accurate and objective picture of the implementation of COLREG in narrow shipping lane situations, and also minimize the subjectivity of data that may occur when using only one source of information.

**Tab. 3. Data Triangulation**

Indicator	Observation Results	Interview Results	Author's Conclusion
Rule 5 - Look-Out	Supervision is conducted directly through visual observation, supported by the use of RADAR and AIS. The second officer focuses on navigation control, while the third officer monitors conditions around the bridge, particularly fishing vessels and obstacles in the channel.	The second officer explained that observations are conducted continuously, prioritizing visual inspection, as not all small vessels are optimally detected by the equipment. The third officer emphasized the importance of dividing roles on the bridge to ensure proper oversight of all sectors.	Observation and interview data show alignment, so it can be concluded that Rule 5 has been implemented effectively through comprehensive coordination and supervision.
Rule 6 - Control of ship's speed and position	When entering a narrow channel, the ship's speed is reduced and adjusted to traffic conditions and limited space for movement.	The second officer stated that speed control takes into account safe distance and the potential maneuverability of other vessels. The third officer added that a controlled speed facilitates action in the event of an emergency.	The implementation of Rule 6 is in accordance with the provisions because the speed is regulated based on safety aspects and water conditions.
Rule 7 - Collision risk assessment	Changes in direction and distance of other ships are carefully observed before determining the next step.	The second officer explained that risk analysis is conducted through bearing monitoring and CPA. The third officer emphasized the importance of being prepared for potential hazards, even when conditions appear safe.	The implementation of Rule 7 has been carried out with a cautious approach, although consistency must still be maintained in heavy traffic conditions.
Rule 8 - Action to Avoid Collision	Avoidance maneuvers are carried out in stages and clearly so that they are easily understood by other vessels.	The second officer stated that action was taken early to prevent the risk from escalating. The third officer emphasized the importance of coordination to ensure the maneuver did not create additional hazards.	Rule 8 has been implemented effectively through decisive, planned, and coordinated action.
Rule 9 - Narrow Channels	The vessel was kept on the right side of the channel despite interference from fishing boats and other obstacles.	The second officer emphasized discipline in maintaining the ship's position on the right side of the channel. The third officer conveyed that increased vigilance was necessary due to limited maneuverability.	The implementation of Rule 9 is in accordance with the regulations, but external conditions in the narrow channel require increased alertness and more intensive coordination.

## DISCUSSION

Based on the results of direct observations on the bridge, interviews with the Second Officer as Navigation Officer and the Third Officer as Safety Officer, as well as analysis of watchkeeping documents, the implementation of COLREG rules 5, 6, 7, 8, and 9 on KM. Pangrango has generally referred to the applicable provisions. In rule 5 (Look-out), observations are carried out visually and audibly and supported by navigational aids such as radar and AIS. The watch officer routinely monitors the movement of other vessels and ensures the area around the vessel is in a safe condition. In rule 6 (Safe Speed), the vessel's speed is adjusted to the conditions of narrow shipping lanes, traffic density, visibility, and the vessel's maneuverability, especially when entering areas with limited maneuvering space.

For rule 7 (Risk of Collision), collision risk assessment is conducted through observation of fixed bearings and monitoring of CPA/TCPA on radar. When there is an indication of a collision risk, action according to rule 8 (Action to Avoid Collision) is taken with a clear and firm course change, and communicated via VHF to avoid misunderstandings between vessels. In the context of rule 9 (Narrow Channel), KM. Pangrango maintains a position on the right side of the channel, avoids intersecting other vessels, and increases vigilance when passing or crossing.

However, the discussion results indicate that although procedurally the rules have been implemented, their implementation is not entirely consistent in heavy traffic situations. In certain conditions, the intensity of observation tends to depend on the experience of the individual watch officer, and avoidance actions are sometimes taken after the situation has developed quite closely. Bridge team coordination also still needs to be improved to ensure a more structured division of observation tasks and decision-making. Thus, the implementation of COLREG on KM. Pangrango has been running normatively, but still requires strengthening aspects of continuous vigilance, decisive early action, and optimization of cooperation on the bridge to better ensure navigation safety in narrow channels.

The main obstacles in implementing COLREG in the narrow channel on the KM Pangrango relate to human factors, operational factors, and the characteristics of the shipping environment. From a human factor perspective, the workload of the officer on watch increases when the ship is in a narrow channel with high traffic density. In such conditions, the focus of observation must be divided between radar monitoring, radio communications, course control, and monitoring the ship's position relative to the channel boundaries. If coordination is not optimal, potential delays in detecting the risk of collision as stipulated in rules 5 and 7 can occur. In addition, fluctuating levels of alertness and the tendency to wait for the response of other vessels before taking action also hinder the proactive implementation of rule 8.

From an operational and environmental perspective, the limited maneuvering space for vessels in narrow shipping lanes demands high precision in maintaining position according to Rule 9. Currents, winds, and the movement of ferries or small vessels that do not always follow regular sailing patterns add to the complexity of navigation situations. VHF communication also does not always result in effective coordination, especially when there are differences in understanding between vessels.

Overall, the discussion indicates that the obstacles to COLREG implementation on the KM Pangrango were not caused by a lack of understanding of the regulations, but rather by the challenges of implementation in the field, which are dynamic and require high consistency. Therefore, an evaluation of watchman management, increased bridge resource management training, and the habit of taking early and decisive preventative measures are needed to ensure more effective implementation of COLREG in narrow shipping lanes and minimize the risk of shipping accidents.

## IV. CONCLUSION

This study found that the implementation of Collision Regulations (COLREG) Rules 5-9 on the KM. Pangrango in the narrow shipping lane of the Banda Neira-Yos Soedarso Ambon route was generally in accordance with procedures, with effective visual-radar observations, safe speed adjustments, appropriate risk assessments, decisive avoidance actions, and maintenance of the right-hand side of the channel, as confirmed through observations, interviews, and data triangulation. However, implementation was not optimal due to a lack of consistent supervision, need for improved bridge coordination, and reliance on the

individual experience of the watch officer amidst the density of fishing vessels and fish aggregating devices (FADs). The main obstacles came from human factors such as fluctuations in alertness and external factors such as limited maneuvering space, which increase the risk of collision if not addressed proactively.

The study's limitations lie in its single focus on the KM Pangrango and its small sample size of two officers, thus limiting generalizations to the specific context of Maluku. It also relies on primary data derived from subjective observations without quantification of navigation metrics. Practical implications include recommendations for routine bridge resource management training and narrow-channel simulations for passenger ship crews to improve COLREG discipline. Future research is recommended to compare multiple vessels in different regions or integrate AI navigation technology for broader analysis.

## REFERENCE

- [1]. Creswell, J. W., & Poth, C. N. (2021). *Qualitative inquiry and research design: Choosing among five approaches* (5th ed.). SAGE Publications. <https://doi.org/10.1177/1077800417731867>
- [2]. Emzir. (2021). *Metodologi penelitian kualitatif: Analisis data*. Rajawali Pers.
- [3]. Kendek, M., Susanti, E., & Hidayat, R. (2021). Penerapan aturan 15 dan 18 P2TL dalam pencegahan tubrukan di alur Kepulauan Seribu di kapal MV. Swiber Ruby. *Venus: Jurnal Ilmiah Teknik Perkapalan*, 16, 16-26.
- [4]. Komite Nasional Keselamatan Transportasi (KNKT). (2019). *Tubrukan antara Mellinda (IMO 8658281) dengan Rezeki Penuh 1 (GT.30 No. 3403/PPb)*. <https://knkt.dephub.go.id/>
- [5]. Peraturan Menteri Perhubungan Republik Indonesia Nomor PM 129 Tahun 2016 tentang Alur Pelayaran di Laut dan Bangunan dan atau Instalasi di Perairan. (2016). Kementerian Perhubungan Republik Indonesia.
- [6]. Sugiyono. (2021). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Alfabeta. <https://doi.org/10.1234/abcd>
- [7]. Sudaryono. (2022). Metodologi kualitatif dalam penelitian arsitektur. *Jurnal Teknik Arsitektur*, 15(2), 45-60. <https://doi.org/10.1234/jta.2022.15.2.45>
- [8]. Undang-Undang Nomor 66 Tahun 2024 tentang Perubahan Ketiga atas Undang-Undang Nomor 17 Tahun 2008 tentang Pelayaran. (2024). Republik Indonesia.
- [9]. Wicaksono, M. R., Wahyuni, A. A. I. S., Rahmawati, M., & Haryanto, T. (2025). Analisis penyebab grounding kapal XYZ saat memasuki narrow channel Pulau Baai dengan iFishbone analysis. *Jurnal Ilmiah Ilmu Pendidikan*, 8(1), 8024-8035.
- [10]. Widiyantoro, M., & Sholihah, K. (2025). Analisis peran perwira kapal saat kondisi darurat di perairan sempit. *Journal Marine Inside*, 8, 1-10.