Analysis of Handling Restricted Visibility on KMP Parama Kalyani in the Framework of Improving Navigation Safety

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This study aims to analyze the procedures for handling restricted visibility and to evaluate their effectiveness in improving navigation safety on board KMP Parama Kalyani. Restricted visibility is one of the major contributing factors to maritime accidents such as collisions and groundings, thus requiring proper implementation of international maritime regulations. The research method used is descriptive qualitative, with data collection techniques including direct observation during sea practice, interviews with ship officers, and documentation. Data analysis was conducted using a gap analysis approach to compare actual practices on board with the standards set by COLREGs and SOLAS. The results indicate that the procedures for handling restricted visibility on board KMP Parama Kalyani are generally in accordance with COLREG Rule 19 and SOLAS Chapter V, including the determination of safe speed, utilization of radar and AIS, use of fog signals, and increased watchkeeping. However, weaknesses were identified in the human factor aspect, particularly delays in reporting weather conditions by the officer on watch, which may pose risks to navigation safety. In conclusion, although the procedures have been properly implemented, improvements in discipline, communication, and situational awareness among crew members are necessary to enhance the effectiveness of handling restricted visibility in order to improve navigation safety.
Keywords: Restricted Visibility, Navigation Safety, COLREG, SOLAS, Human Factor

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1. Introduction

Maritime transportation plays a crucial role in the global economy, as more than 80% of world trade is conducted by sea (Siswanto et al., 2023). In the context of Indonesia, an archipelagic nation with approximately 17,000 islands, maritime transportation serves as the primary link for the distribution of goods, industrial raw materials, and strategic commodities between regions. Nurhanisa (2022) explains that ships function as "connecting bridges" that ensure the smooth distribution of national logistics, including agricultural and fishery products, as well as the needs of the manufacturing industry, which relies on maritime export and import routes. Therefore, shipping safety is a crucial factor in maintaining the stability of global and national supply chains and trade.

Despite its vital role, shipping also faces various operational risks, one of which is restricted visibility. This presents a serious challenge because it can increase the risk of accidents such as collisions and groundings. Data from the International Maritime Organization (IMO) and Allianz Global Corporate & Specialty (AGCS) indicates that poor visibility is a major contributing factor to fatal maritime accidents. These risks not only cause material losses and loss of life, but also impact environmental damage and disrupt logistics flows.

Developments in navigation technology such as radar, Automatic Identification System (AIS), Electronic Chart Display and Information System (ECDIS), and Global Positioning System (GPS) have indeed helped improve shipping safety. However, over-reliance on technology can also create new risks, such as data

misinterpretation and equipment failure. Therefore, the International Regulations for Preventing Collisions at Sea (COLREGs) 1972 Rule 19 concerning "Conduct of Vessels in Restricted Visibility" stipulates safety procedures such as speed reduction, use of fog signals, and increased watchkeeping. However, the implementation of these rules is heavily influenced by human factors, such as fatigue, work pressure, lack of training, and complacent behavior.

In a sea practice conducted by the author on the KMP Parama Kalyani on November 19, 2024, heavy rain and strong winds reduced visibility to less than 0.5 nautical miles during the voyage to Padangbai. These conditions pose a real challenge to the implementation of navigational safety procedures and onboard decision-making. Compliance with procedures in the COLREGs and Safety Management System (SMS), as well as crew readiness, are key factors in maintaining safe navigation. Based on these conditions, this study was conducted to analyze the handling of limited visibility on the KMP Parama Kalyani to improve navigational safety and identify gaps between regulations and field practice.

Based on the above background, this study aims to: (1) Determine whether the procedures for handling limited visibility are implemented by the Officer on Watch on the KMP Parama Kalyani. (2) Evaluate the effectiveness of the implementation of procedures for handling limited visibility on the KMP Parama Kalyani in supporting navigational safety.

2. Method

This research employed a qualitative descriptive method, focusing on describing facts in the field using theory as a guide for analysis. The author did not use statistical data but instead focused on observations, interviews, documentation, and direct experience during maritime practice. This method was chosen because it was considered capable of assessing the risk of ship accidents under conditions of limited visibility. This analysis included the application of COLREGs Rule 19, SOLAS Chapter V, the use of navigational aids such as RADAR, AIS, and ECDIS, and navigational decision-making such as determining safe speed, ship maneuvering, and watchkeeping. Gap analysis was used to identify the gap between ideal procedures and field practices, allowing for recommendations for improving procedures and navigational safety training.

Operational definitions of variables in this study include limited visibility, navigational safety, and the captain and deck crew. Limited visibility is defined as conditions that reduce visual navigation capabilities due to fog, heavy rain, thick smoke, or very dark nights. Navigational safety is measured through the implementation of safety procedures, the use of navigational aids, proactive measures, and the quality of communication between crew members. Navigational safety is measured by the absence of accidents or near-misses during a voyage, while the captain and deck crew are the human resources directly responsible for the ship's navigational operations.

Data collection techniques included observation, interviews, and documentation. Direct observations were conducted to examine the implementation of navigational regulations during periods of limited visibility. Interviews were conducted with the captain and deck officers to obtain in-depth information regarding procedures, experiences, and decision-making practices in actual operational situations on board. The interview data were transcribed into text form and organized using NVivo software to facilitate data management, coding, and thematic categorization. The use of NVivo assisted the researcher in systematically organizing qualitative data and identifying relationships among the information obtained from participants. Documentation was carried out by reviewing documents and records related to navigational activities and incidents on board.

The collected data were analyzed descriptively through a process of data reduction, selection of relevant information, data organization, and systematic presentation to facilitate understanding and interpretation. NVivo was used solely as a supporting tool for managing and organizing interview data, while the main analysis remained based on descriptive qualitative interpretation of the findings.

3. Results And Discussion

Research Results

KMP Parama Kalyani is an Indonesian-flagged passenger and vehicle ferry (ro-ro passenger ferry) registered at the port of Padangbai, Bali/ Lembar, Lombok. It is part of the fleet of PT. Jemla Ferry, a national shipping company headquartered in Jakarta, Indonesia. This vessel is specifically designed to transport passengers, two-wheeled vehicles, four-wheeled vehicles, and general cargo on inter-island ferry routes. The vessel was built in 2018 at the PT. Bandar Abadi shipyard in Batam and launched in 2019. KMP Parama Kalyani has a length overall (LOA) of 76 meters, a beam of 15 meters, and a main deck height of 4 meters. The vessel has a gross tonnage (GT) of 1,751 GT and a permitted capacity of 1,000 passengers and dozens of vehicles. The vessel is equipped with two main engines with a power of 1,180 kW/1,600 hp, providing a service speed of approximately 14 knots. The KMP Parama Kalyani sails in Indonesian waters while upholding the highest safety standards. Every voyage is ensured to avoid the risk of accidents or other undesirable incidents to ensure the safety of the ship, passengers, cargo, and the entire crew.

Navigational safety is an absolute priority in shipping, given that accidents at sea can be fatal and cause significant material and non-material losses. Bad weather, particularly limited visibility, is a leading trigger for maritime incidents. Therefore, precise navigation and effective communication are key to mitigating risks when ships navigate areas of low visibility, ensuring the safety of the ship, crew, and cargo.

This study presents the core findings obtained through a data analysis process that addresses the research objectives and questions. The results include processed and interpreted data to provide a comprehensive and objective picture of the phenomenon of limited visibility management on the KMP Parama Kalyani. The presentation is systematic, starting with the identification of factual conditions, evaluation of applicable procedures, and analysis of their impact on navigational safety. This ensures that readers can clearly understand the logical relationship between the data, findings, and answers to the research questions raised.

Procedures Followed by the Officer on Watch on Board

This research will describe a real-life incident that occurred during a sea practice (prala) on the KMP Parama Kalyani, owned by PT. Jemla Ferry. The incident in question concerns limited visibility during the sea practice on the KMP Parama Kalyani on November 19, 2024, specifically as the ship was about to depart for Padangbai after docking at Lembar Port. The following describes the sailing data during the limited visibility situation:

Date and Time: November 19, 2024
Last Port: Lembar
Next Port: Padangbai
Crew on Board:

On the afternoon of November 19, 2024, the KMP Parama Kalyani received an email from the office containing a weather report from the Meteorology, Climatology, and Geophysics Agency (BMKG) regarding the daily weather forecast and wave height in Indonesian waters, particularly the Lombok Strait. An early

warning was issued regarding the potential for heavy rain accompanied by strong winds which could reduce visibility.

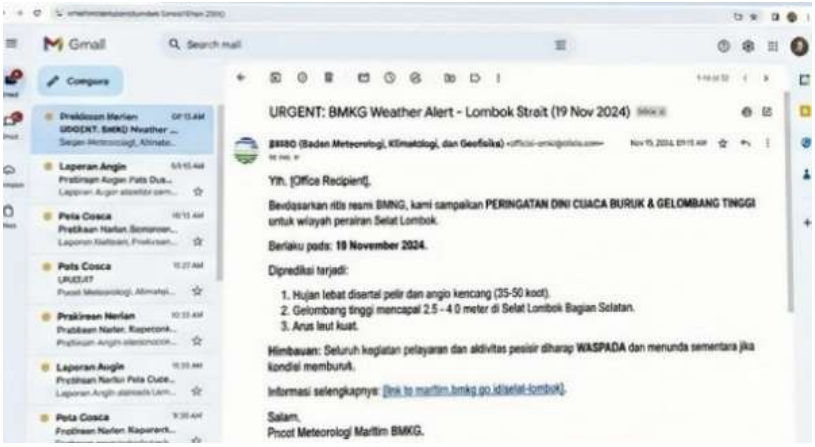


Figure 1. Weather Report Email
Source: KMP Parama Kalyani Documentation

While the 76-meter-long KMP Parama Kalyani was sailing along the Lombok Strait crossing from Lembar to Padangbai, the initially clear weather drastically changed. The ship entered an area of extremely heavy rain accompanied by strong winds estimated at 30-35 knots. These conditions drastically reduced horizontal visibility in the area to less than 0.5 nautical miles (approximately 900 meters), far below the safe limit for visual navigation. The sea became choppy with waves reaching 2.5 to 3 meters high.

Around 12:46 p.m. WITA (Central Indonesian Time), the officer on navigational watch duty on the bridge, the third mate, did not report the extreme weather conditions to the captain. He assumed that the heavy rain and the ship's rocking due to the waves in the Lombok Strait during the November rainy season were normal or commonplace.

Based on field observations on November 19, 2024, and the reconstruction of the incident, the procedures implemented upon entering an area of restricted visibility complied with applicable regulations, as detailed below:

a. Compliance with COLREG (International Regulations for Preventing Collisions at Sea)

In accordance with COLREG 2020 Rule 6 concerning safe speed, the officer on watch immediately determined a safe speed, taking into account visibility conditions of less than 0.5 nautical miles. This action was taken to ensure the vessel could still stop or maneuver safely within the available visibility, as stipulated in Rule 6(b)(i), which states that limited visibility is a primary factor in determining a safe speed.

In addition, COLREG 2020 Rule 19 concerning vessel conduction in restricted visibility was also implemented by activating radar and using a short-range scale of 1.5 miles to detect objects around the vessel early. The officer on watch also sounded a fog signal using the ship's whistle, consisting of one long blast at intervals of no more than two minutes, in accordance with Rule 35 concerning fog signals for vessels underway. The situation is then immediately reported to the captain as a precautionary measure so that decisions can be made directly by the highest authority on board.

b. Compliance with SOLAS (Safety of Life at Sea) and STCW

In accordance with SOLAS Chapter V Regulation 19 on navigational safety, the officer in charge of the watch uses radar and AIS as primary aids to navigation in conditions of limited visibility. Radar is activated at a scale of 1.5 nautical miles, and AIS is monitored periodically to identify target movements around the

ship. This action is taken because radar and AIS serve as primary means of detecting navigational situations when visual observation is limited.

The implementation of STCW Code Section A-VIII/2 on the principle of navigational watchkeeping is also evident in the officer in charge's actions, who promptly reports to the captain when visibility drops below 0.5 nautical miles. This aligns with the officer in charge's obligation to immediately summon the captain in deteriorating weather conditions or when visibility is limited. In addition, the watch officer remains focused on radar and AIS monitors and reports any suspicious targets periodically as a form of increased vigilance in hazardous navigation conditions.

c. Use of Radar, AIS, and ECDIS in Appropriate Procedures

The Officer of the Watch uses a short-range radar of 1.5 miles to detect other vessels, obstacles, and coastlines in conditions of limited to near-zero visibility. This short-range radar is considered appropriate because visibility of less than 0.5 nautical miles allows for target detection at a safe distance for maneuvering. Furthermore, the Officer of the Watch conducts regular observations through plotting or MARPA, if available, to determine the CPA (Closest Point of Approach) and TCPA (Time to Closest Point of Approach) of each target in the vessel's vicinity.

The AIS (Automatic Identification System) is used to obtain digital information regarding the identity, position, course, and speed of other vessels. In practice, the Officer of the Watch monitors and reports any movement of targets deemed suspicious, such as vessels with potentially dangerous courses or abnormal speeds. AIS helps confirm radar data, thereby reducing the risk of collisions due to misidentified targets. In addition, the ECDIS (Electronic Chart Display and Information System) displays the ship's position in real time on an electronic map and provides warnings regarding contour limits, depth, and safe navigation lanes. Although not directly mentioned in the Officer of the Watch's statement, the use of ECDIS in SOLAS-compliant navigation practices is crucial to ensuring the ship remains within the narrow Lombok Strait shipping lanes. This system also helps provide warnings of off-track conditions and critical depth conditions, especially during times of limited visibility and high waves.

d. Results of Onboard Interviews

Based on interviews regarding safe speed, maneuvering, and watchkeeping during limited visibility conditions on the KMP Parama Kalyani on November 19, 2024, it was found that determining safe speed was done by considering the ship's ability to stop or maneuver within the available visibility. The interviewees explained that the ship's speed was reduced to between 5 and 8 knots, depending on current conditions, traffic density, and ship characteristics. This demonstrates that the safe speed determination applied the precautionary principle as stipulated in COLREG Rule 19 by adjusting the speed to environmental conditions and the navigation situation.

During maneuvering, all interviewees emphasized that course alterations must be carried out carefully, gradually, and in a planned manner to avoid the risk of excessive rolling or loss of control, especially in rough sea conditions. Maneuvering actions were also performed by considering wave direction (*head sea* conditions) and maintaining coordination with the engine room to ensure engine readiness in responding to navigational commands. Therefore, the maneuvering practices reflected the application of caution and effective coordination in accordance with safe navigation principles.

Meanwhile, regarding watchkeeping, all interviewees stated that vigilance on the bridge must be enhanced during limited visibility conditions through the optimal use of RADAR and AIS, the regular sounding of fog signals, and the assignment of additional watch personnel such as a lookout at the bow. Officers on watch are also required to immediately report any significant reduction in visibility to the Master without delay. In

general, the watchkeeping system was implemented in accordance with the requirements of STCW and COLREGs, although potential weaknesses in reporting discipline were identified.

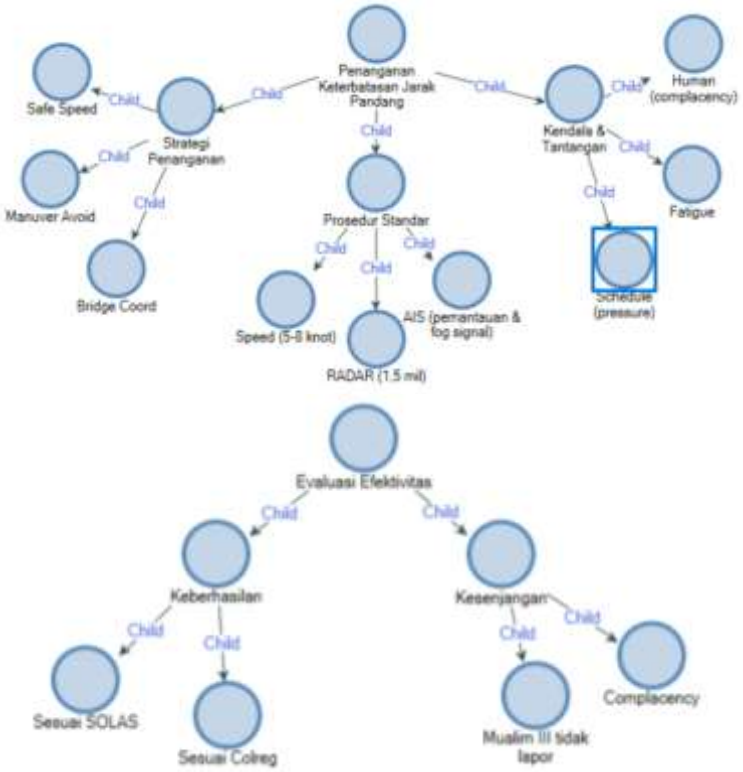


Figure 2. NVivo Project Map of Interview Data Analysis

Figure 2 presents the NVivo 12 project map generated from the interview data analysis. The NVivo analysis revealed that Limited Visibility Handling emerged as the primary parent node, which was divided into three major categories: Standard Procedures, Handling Strategies, and Constraints and Challenges. Under the Standard Procedures category, the dominant sub-nodes included the use of RADAR with a 1.5-nautical-mile range setting, AIS monitoring, and the regular sounding of fog signals. The Handling Strategies category consisted of three main components, namely Safe Speed Determination, Avoidance Maneuvering, and Bridge Coordination. Meanwhile, within the Constraints and Challenges category, the human factor of complacency emerged as the most significant challenge, followed by fatigue and schedule pressure.

The NVivo findings strengthen the interview results by showing that although standard procedures are generally well understood and implemented, human factors remain a significant obstacle to the effective management of limited visibility situations. Based on the NVivo project structure, the analysis can be divided into two main aspects: successes and gaps. From the perspective of successes, the procedures implemented on board were found to be consistent with the requirements of COLREGs and SOLAS, indicating compliance with international maritime safety standards. However, from the perspective of gaps, complacency was identified as a contributing factor that resulted in the Third Officer failing to promptly report deteriorating visibility conditions to the Master. This finding highlights that, despite the availability of adequate navigational equipment and compliance with regulations, individual awareness and human performance remain critical factors influencing the effectiveness of limited visibility management.

Discussion

Procedures for Handling Limited Visibility Conditions

When the KMP Parama Kalyani handled limited visibility conditions during its Lembar-Padangbai voyage on November 19, 2025, an in-depth discussion of each informant's responses was conducted. This discussion drew on navigation theory, international regulations (COLREG), standard operating procedures, and literature related to maritime safety.



Figure 3. Weather from the Ship's Bow
Source: KMP Parama Kalyani Documentation



Figure 4. Weather from the South of the Ship
Source: Documentation of KMP Parama Kalyani

a. Early Detection of Limited Visibility Conditions

The informant stated that he first became aware of the limited visibility conditions when he saw a significant change in the weather, namely dense black clouds from the south, followed by heavy rain that reduced visibility to less than 0.5 miles.

The watch officer's ability to detect early changes in weather conditions is a critical aspect of navigational safety. A navigator must be sensitive to signs of changing weather conditions such as changes in sky color, wind direction, and cloud patterns. In this case, the watch officer demonstrated good alertness by immediately recognizing that visibility had drastically decreased. This ability allows the watch officer to understand environmental elements and project their status into the future. High situational awareness allows the watch officer to take preventative action before the situation worsens.

b. Procedural Actions Upon Entering an Area of Limited Visibility

The first action taken by the watch officer was to report the conditions to the captain, activate the short-range radar, sound the fog signal, and add observers to the wing bridge.

The officer's actions demonstrated a good understanding of standard operating procedures when faced with limited visibility. According to COLREG Rule 35 (Sound Signals in Limited Visibility) of 1972, a sailing vessel is required to sound the whistle with one prolonged blast at intervals of no more than 2 minutes. Activating short-range radar is also appropriate because in conditions of limited visibility, detection of objects around the vessel is a top priority. The use of short-range radar allows for earlier detection of small vessels or obstacles that may not be detected at a distance. The addition of observers on the wing bridge is in accordance with COLREG Rule 5 (Observation), which states that every vessel must maintain a proper lookout using sight, hearing, and all available means. The procedural actions taken by the Third Officer of the Watch on the KMP Parama Kalyani when faced with a situation of limited visibility met the safety requirements mandated in SOLAS Chapter V. Based on the analysis of the procedures carried out, the Officer of the Watch demonstrated compliance with international regulations by optimizing the use of electronic navigation equipment such as radar and ARPA to monitor the movements of other vessels in the vicinity, as required by SOLAS Regulation 19, which requires ships to be equipped with navigation detection systems for safe navigation.

Furthermore, the Officer of the Watch's actions in increasing vigilance and strengthening visual observation by involving additional watch crew at strategic positions also reflected the implementation of the principle of SOLAS Regulation 22 regarding visibility from the bridge, which emphasizes the importance of a clear line of sight for safe navigation. This procedural compliance demonstrates that safety management on the KMP Parama Kalyani was effective in mitigating the risk of collision, where the Officer of the Watch did not rely solely on instinct but disciplinedly referred to standard operational guidelines derived from global maritime conventions.

c. Determining Safe Speed

The officer on watch determines a safe speed by considering visibility (<0.5 miles), traffic density in the Lombok Strait, the ship's maneuverability (high-rise Ro-Ro vessels), and radar conditions. The speed is reduced from 12 knots to 6-8 knots.

Determining a safe speed is one of the most crucial aspects of navigation in restricted visibility. COLREG 1972 Rule 6 (Safe Speed) states that every vessel must always proceed at a safe speed so that it can take appropriate and effective action to avoid collision. Factors to consider include visibility, traffic density, ship maneuverability, and radar conditions. The officer on watch's decision to reduce the speed from 12 knots to 6-8 knots was the correct decision. According to stopping distance calculations (Zhang et al., 2025), a 60-meter-long vessel requires a distance of approximately 5-6 times its length [HA1.1] to come to a complete stop, depending on speed. With a speed of 6-8 knots and a visibility of 0.5 miles (approximately 926 meters), the ship still has sufficient time and space to maneuver if danger arises ahead. However, this

speed must also take into account steerage (Sakuma & Naruse, 2017), which is the minimum speed required to maintain control of the ship, which for Ro-Ro ships is typically around 3-4 knots. [HA2.1]

d. Integration of Information from Radar, AIS, and Visual/Auditory

The officer on watch stated that in conditions of limited visibility, radar is the primary source of information, integrated with AIS data for vessel identification and CPA/TCPA analysis, while visual and auditory information are used for confirmation.

Integration of multiple sources of navigation information is a best practice in modern navigation. Radar provides information on the position and movement of targets, while AIS provides data on the vessel's identity, size, and route. The combination of radar and AIS improves the accuracy of situation assessment by up to 85% compared to relying on a single instrument alone. The use of AIS Closest Point of Approach (CPA) and TCPA (Time to Closest Point of Approach) allows the officer on watch to quantitatively predict the potential for collision.

COLREG Rule 7 (Collision Risk Assessment) states that the assessment must be made using all available means. The informant's continued use of visual and auditory confirmation is also appropriate, as in certain circumstances (e.g., vessels without AIS or undetectable radar), direct observation is still necessary.

e. Radar Target Analysis to Detect Collision Risk

The officer of the watch plots the target, observes changes in bearing, and monitors the CPA/TCPA values from the AIS. If the bearing remains relatively constant and the distance decreases, it is considered an indication of a collision risk. A CPA of <0.5 miles in a narrow strait is considered a close-quarters situation.

The analysis method used by the informant complies with the principles of radar navigation. COLREG Rule 7(b) explicitly states that a collision risk should be assumed if the approaching vessel's bearing does not change significantly. In radar plotting practice, relative motion analysis techniques are used to determine whether two vessels will be in the same position at the same time. Determining a CPA of <0.5 miles as the limit for a close-quarters situation in the Lombok Strait is a well-thought-out decision considering the limited width of the shipping lane. In a narrow channel like the Lombok Strait, the minimum safe distance between vessels in conditions of limited visibility is 0.7 miles for medium-sized vessels. By setting a limit of 0.5 miles, the informant provides a sufficient safety margin while remaining realistic given the local geographic conditions.

f. Evasive Action in the Event of Risk of Collision

The Officer of the Watch's first priority is to further reduce speed or stop the vessel to assess the situation. If maneuvering is necessary, the course change is carried out cautiously in accordance with COLREG Rule 19, avoiding a course change to port if there is a vessel ahead or on the port side.

The Officer of the Watch's actions are in strict accordance with COLREG Rule 19 (Conduct of Vessels in Restricted Visibility). This rule states that if another vessel is detected and a risk of collision is imminent, a vessel must take evasive action in a timely manner. However, unlike the rules in normal visibility (Rules 14-17), in fog no vessel has absolute right of way. Every vessel is obligated to take evasive action. Reducing speed or stopping the vessel is prudent when the situation is unclear, as it allows time to assess and avoid actions that could confuse other vessels. The prohibition on altering course to port for vessels detecting another vessel ahead or on the port side is based on the consideration that the vessel ahead may also be maneuvering to starboard. Altering course to starboard is a more predictable and universally safe action.

g. Team Coordination on the Bridge

Once the Master arrives on the bridge, a clear division of tasks occurs: the Master is the decision-maker, the Officer of the Watch focuses on radar/AIS, while other crew members assist with VHF communications, and lookouts on the wing bridges listen for fog signals. Communication is conducted calmly, concisely, and clearly.

Effective bridge resource management (BRM) is a key factor in safe navigation. According to the International Maritime Organization (IMO), BRM is the effective utilization of all available resources on the bridge, including people and equipment, to achieve the goal of safe navigation. A clear division of tasks prevents overlapping responsibilities and ensures that every aspect of navigation is monitored. The placement of lookouts on the wing bridges is especially important in fog conditions because sound can provide the earliest source of information about the presence of other vessels before they are detected by radar. Calm and concise communication reduces the risk of misunderstandings that can have fatal consequences.

h. Obstacles and Challenges to Implementing Ideal Procedures

Watch officers identified schedule pressure and fatigue as the biggest challenges. The pressure to arrive on time often forces ships to sail despite less-than-ideal conditions, increasing stress and the risk of accidents.

This finding is crucial because it touches on aspects of operational management and human factors that are often overlooked. Schedule pressure in the commercial shipping industry is a difficult reality to avoid. In conditions of limited visibility, the technically safest decision is to delay departure or anchor until conditions improve. However, this decision often conflicts with commercial interests. Fatigue affects the watch officer's cognitive abilities, decreasing concentration, slowing reaction times, and impairing decision-making ability. The combination of schedule pressure and fatigue creates extremely dangerous conditions, especially in critical situations such as limited visibility.

Analysis of Compliance with International Regulations and Standards

Based on the discussion above, the compliance of the watch officer's actions with various international regulations and standards can be analyzed:

Table 1. Compliance of Actions with International Standards

Aspects	Operational Actions	Regulatory/Standard References	Compliance
Early Detection	Aware of weather changes and reduced visibility	*COLREG Rule 5* (Pengamatan)	Compliance
Reporting	Report to the Master	*ISM Code,* SOP Kapal	Compliance
Fog Signals	Sound	*COLREG Rule 35*	Compliance
Aspects	Operational Actions	**Regulatory/Standard References**	Compliance
	1 long blast of the whistle (<2 minutes)	*COLREG Rule 35*	Compliance
Radar Use	Activate short-range radar	*COLREG Rule 7* (Penilaian Risiko)	Compliance
Safe Speed	Reduce from 12 to 6-8 knots	*COLREG Rule 6*	Compliance
Risk Analysis	Monitor bearing, CPA, TCPA	*COLREG Rule 7*	Compliance

Evasion Action	Reduce speed, stop, change course to starboard	*COLREG Rule 19*	Compliance
Team Coordination	Segregation of tasks, effective communication	*IMO BRM Guidelines*	Compliance

Source: Researcher Observation Results. 2025

Overall, interview results with respondents indicate that the KMP Parama Kalyani's watch officers have implemented procedures for handling limited visibility effectively and in accordance with international regulations. Actions taken include early detection, reporting to the Master, optimal use of radar and AIS, determining a safe speed, analyzing the risk of collision, taking appropriate evasive action, and effective team coordination. However, the main challenges faced are schedule pressure and fatigue, which are external factors beyond the watch officers' control. This indicates that operational management and human factors require more serious attention in efforts to improve shipping safety, particularly on busy routes such as Lembar-Padangbai [HA1.1].

Based on the research findings, the KMP Parama Kalyani's watch officers have implemented safety procedures in accordance with COLREG and SOLAS when facing limited visibility. Several recommendations for improvement can be made to maximize safety in the future. In terms of procedural improvements, although the actions taken are in accordance with regulations, improvements need to be made through more structured documentation of emergency response procedures for extreme visibility situations. Related research indicates that watch officers must follow existing regulations, such as fog signals, and maintain proper surveillance, utilizing facilities and infrastructure to the fullest. Therefore, standard operating procedures on the KMP Parama Kalyani could be supplemented with a specific checklist for limited visibility conditions, including steps to verify radar use, communication with other vessels, and identification of vulnerable points in the shipping lane that require extra vigilance, thereby minimizing the potential for negligence due to fatigue or distraction.

Meanwhile, training recommendations are crucial for maintaining and improving watch officers' competency in dealing with similar situations. Navigational training enhances watch officers' knowledge and skills, thus avoiding navigational hazards. Regular training using a bridge simulator with limited visibility scenarios could be an effective solution, as the simulation system can realistically reproduce all ship operations and reactions under various complex conditions, such as bad weather, strong currents, or limited visibility, which are difficult to replicate in training on a real ship. In addition, drills and training on board aim to improve the skills and knowledge of all crew members in dealing with emergency situations, so shipping companies need to schedule regular training that not only focuses on technical aspects but also on quick decision-making and effective communication on the bridge when visibility decreases drastically.

4. Conclusion

Based on the research results and discussions that have been described, it can be concluded that the procedures carried out by the KMP Parama Kalyani watch officers in handling conditions of limited visibility are generally in accordance with international standards, especially the provisions of COLREG Rule 19, SOLAS Chapter V, and STCW. These procedures include determining a safe speed, the use of radar and AIS, sounding a fog signal, and increasing vigilance on the ship's bridge. The implementation of these procedures has proven effective in supporting navigational safety, as indicated by the absence of accidents during the incident and the ability of the watch officers to utilize navigation equipment optimally. However, weaknesses in the human factor were still found, especially the initial delay in reporting weather conditions to the captain which has the potential to increase risks if not immediately addressed. Overall, the procedures

for handling limited visibility on the KMP Parama Kalyani have been effective in maintaining navigational safety during the incident on November 19, 2024, but improvements in aspects of fatigue management and schedule pressure are still needed so that the effectiveness of the procedures can be maintained continuously.

5. References

Fitrial, D., Purba, D., & Setiawan, A. (2022). *Optimalisasi Alat Navigasi Radar Di Atas Kapal MV. Tanto Mandiri Saat Memasuki Alur Pelayaran Sempit*. Meteor STIP Marunda, 15(2). https://doi.org/10.36101/msm.v15i2.249. Diakses pada tanggal 20 Oktober 2025.

Furqon, A., Boer, R., Hidayat, R., Perdinan, & Sopaheluwakan, A. (2019). *Pengaruh Garis Pantai Berbentuk Teluk Terhadap Peningkatan Curah Hujan Pesisir di Benua Maritim Indonesia*. Repository Ipb.

Greenwood, S. A., et al. (2022). *The effect of intravenous iron supplementation on exercise capacity in iron-deficient but not anaemic patients with chronic kidney disease: study design and baseline data for a multicentre prospective double-blind randomised controlled trial*. BMC Nephrology, 23(1). https://doi.org/10.1186/s12882-022-02896-3. Diakses pada tanggal 20 Oktober 2025.

Hidayatulloh, I., & Arman, Z. (2022). *Analisis hukum terhadap peran Syahbandar dalam pengawasan evakuasi kapal kandas di perairan laut*. Jurnal Cakrawala Hukum, 13(1). https://doi.org/10.26905/idjch.v13i1.7440. Diakses pada tanggal 20 Oktober 2025.

Melnyk, O., Onishchenko, O., Vasalatii, N., & Varlan, T. (2022). *INTRODUCTION OF MODERN MARINE TECHNOLOGIES IN SHIP NAVIGATION PROCESS*. Grail of Science, 18–19. https://doi.org/10.36074/grail-of-science.26.08.2022.33. Diakses pada tanggal 20 Oktober 2025.

Millenia, Y. W., Helmi, M., & Maslukah, L. (2023). *Analisis Mekanisme Pengaruh IOD, ENSO dan Monsun terhadap Suhu Permukaan Laut dan Curah Hujan di Perairan Kepulauan Mentawai, Sumatera Barat*. Indonesian Journal of Oceanography, 4(4). https://doi.org/10.14710/ijoce.v4i4.14414. Diakses pada tanggal 29 Oktober 2025.

Nicolaus, M., Perovich, D., et al. (2022). *Overview of the MOSAiC expedition: Snow and sea ice*. Elementa, 10(1). https://doi.org/10.1525/elementa.2021.000046. Diakses pada tanggal 29 Oktober 2025.

Nurhanisa, yuli. (2022). *Jumlah pulau di Indonesia capai 17.000*. Indonesiabaik.Id.

Nursyamsu, Herningsih, S. W., & Zulviananda, M. F. (2021). *Optimalisasi Penggunaan ARPA (Automatic Radar Plotting Aid) Guna Meminimalisir Kecelakaan di Laut*. Journal Marine Inside. https://doi.org/10.56943/ejmi.v3i2.30. Diakses pada tanggal 20 Oktober 2025.

Outay, F., Ahmar, A. U. H., Kamoun, F., Yasar, A. U. H., Sommer, C., Jabeur, N., & El-Amine, S. (2019). *Investigation of the impact of a wireless Fog Warning System with respect to road traffic on a highway*. Personal and Ubiquitous Computing, 23(5–6). https://doi.org/10.1007/s00779-018-1151-4. Diakses pada tanggal 20 Oktober 2025.

Pe'eri, S., & Dyer, N. (2019). *Adding value to ENCs: Land features*. Abstracts of the ICA, 1. https://doi.org/10.5194/ica-abs-1-293-2019. Diakses pada tanggal 20 Oktober 2025.

Pietrzykowski, Z., Siemianowicz, M., & Wielgosz, M. (2019). *Ship Domain in Various Visibility Conditions in Restricted Waters*. Annual of Navigation, *25*(1). https://doi.org/10.1515/aon-2018-0003. Diakses pada tanggal 20 Oktober 2025.

Psaraftis, H. N., & Zis, T. (2022). *Shipping decarbonization and green ports*. In Maritime Transport Research (Vol. 3). https://doi.org/10.1016/j.martra.2022.100068. Diakses pada tanggal 29 Oktober 2025.

Sakuma, S., & Naruse, T. (2017). On the Numerical Method for Analyzing the Steering Quality Indices with the Drift Angle Considered. *Journal of the Japan Society of Naval Architects and Ocean Engineers*, *25*(0). https://doi.org/10.2534/jjasnaoe.25.1. Diakses pada tanggal 10 Maret 2026.

Siswanto, S., Permady, G. C., Idris, M., & Setiyono, M. (2023). *ANALISA PENGARUH SEKOLAH PELAYARAN YANG BERKUALITAS TERHADAP PERTUMBUHAN EKONOMI DI KOTA MAKASAR*. JPB : Jurnal Patria Bahari, 2(2). https://doi.org/10.54017/jpb.v2i2.56. Diakses pada tanggal 29 Oktober 2025.

Sutryani, H., Dewi, A. K., & Wibowo, I. R. (2021). *Penggunaan Peralatan Navigasi untuk Menghindari Terjadinya Kecelakaan Kapal*. Journal Marine Inside. https://doi.org/10.56943/ejmi.v3i1.28. Diakses pada tanggal 20 Oktober 2025.

Szlapczynski, R. (2015). *Evolutionary planning of safe ship tracks in restricted visibility.* Journal of Navigation, 68(1). https://doi.org/10.1017/S0373463314000587. Diakses pada tanggal 20 Oktober 2025.

Wang, T., Wang, Y., Li, X., & Wang, J. (2023). *Evacuation performance on offshore platforms under different visibility conditions*. Physica A: Statistical Mechanics and Its Applications, 620. https://doi.org/10.1016/j.physa.2023.128765. Diakses pada tanggal 29 Oktober 2025.

Zhang, J., Zhang, Y., Ren, M., Jing, X., Shen, Y., & Liu, Y. (2025). Research on Stopping Distance and Latest Safe Maneuvering Point Based on the Newell Model. *Proceedings of the International Offshore and Polar Engineering Conference*. Diakses pada 10 Maret 2026.