Analysis of the Preparedness of the Yogyakarta Search and Rescue Office in Responding to Accidents in the Waters of Parangtritis Beach

Analisis Kesiapsiagaan Kantor Pencarian dan Pertolongan Yogyakarta dalam Merespon Kejadian Kecelakaan di Perairan Pantai Parangtritis

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ABSTRACT
This study aims to analyze the level of preparedness of the Yogyakarta Search and Rescue Office in responding to accidents in the waters of Parangtritis Beach, Bantul Regency. Using a qualitative descriptive approach, data were obtained through interviews, observations, and documentation of SAR personnel and the surrounding community. The results indicate that the Yogyakarta Search and Rescue Office has a good level of preparedness, indicated by the availability of rotating standby officers, the readiness of facilities and infrastructure, and the implementation of special alerts. However, challenges remain, particularly in terms of the limited number of personnel to handle large-scale incidents, low public awareness, and the lack of early detection tools. The weaknesses of this study lie in its limited scope, which focuses only on Parangtritis Beach, so the results cannot be generalized to other coastal areas. Furthermore, it is recommended that further research conduct comparative studies in various vulnerable coastal tourist areas, integrate IoT-based early warning technology analysis, and expand local community participation to obtain a more comprehensive picture of preparedness. Collaborative efforts between agencies and increased public education remain important factors in increasing the effectiveness of responses to accidents in the waters.

Kata Kunci
Kesiapsiagaan;
Pencarian & Penyelamatan;
Pantai Parangtritis;
Kecelakaan Laut;

ABSTRAK
Penelitian ini bertujuan untuk menganalisis tingkat kesiapsiagaan Kantor Pencarian dan Pertolongan Yogyakarta dalam merespons kejadian kecelakaan di perairan Pantai Parangtritis, Kabupaten Bantul. Menggunakan pendekatan deskriptif kualitatif, data diperoleh melalui wawancara, observasi, dan dokumentasi terhadap personel SAR dan masyarakat sekitar. Hasil penelitian menunjukkan bahwa Kantor Pencarian dan Pertolongan Yogyakarta memiliki tingkat kesiapsiagaan yang baik, ditunjukkan dengan ketersediaan petugas siaga secara bergiliran, kesiapan sarana dan prasarana, serta pelaksanaan siaga khusus. Namun demikian, tantangan masih ditemukan terutama dalam hal keterbatasan jumlah personel untuk menangani kejadian dalam skala besar, rendahnya kesadaran masyarakat, dan kurangnya alat deteksi dini. Kelemahan kajian ini terletak pada keterbatasan ruang lingkup yang hanya berfokus pada Pantai Parangtritis sehingga hasilnya belum dapat digeneralisasi untuk wilayah pantai lain, serta keterbatasan data lapangan yang masih dipengaruhi kondisi musiman. Untuk itu, penelitian selanjutnya direkomendasikan melakukan kajian komparatif di berbagai kawasan wisata pantai rawan, mengintegrasikan analisis teknologi peringatan dini berbasis IoT, serta memperluas partisipasi masyarakat lokal guna memperoleh gambaran kesiapsiagaan yang lebih komprehensif. Upaya kolaboratif antarinstansi dan peningkatan edukasi masyarakat tetap menjadi faktor penting dalam meningkatkan efektivitas respons terhadap kecelakaan di perairan.

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Introduction

Indonesia is an archipelagic country with the second-longest coastline in the world and a high potential for disasters due to its geographical and geological conditions. According to data from the National Disaster Management Agency (BNPB), the number of natural disasters in Indonesia has fluctuated over the past five years. This data is important for demonstrating disaster trends that can impact the preparedness of various agencies, including the Search and Rescue Office. The following figure presents the trend of natural disasters in Indonesia from 2020 to June 2024:

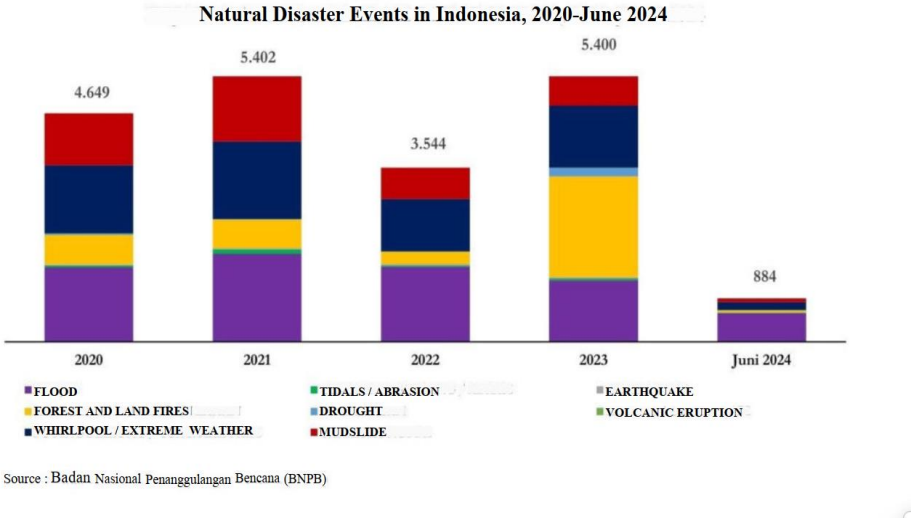

Figure 1. Trends in disaster events over the last 5 years in Indonesia

Source: Financial Notes Book & 2025 Draft State Budget on Natural Disasters in Indonesia in the Last 5 Years (Doc: BNPB)

One area at high risk of marine disasters is the Special Region of Yogyakarta (DIY), particularly the Parangtritis Beach area in Bantul Regency. This beach is a prime tourist destination, attracting over two million visitors annually. However, the beach's natural beauty also poses significant potential hazards, such as high waves, rip currents , and the presence of ocean trenches that frequently cause accidents and fatalities. Data from the Satlinmas Rescue Region III recorded that in 2023, there were 15 accidents at Parangtritis Beach, a significant increase compared to previous years.

The Yogyakarta Search and Rescue Office, as a technical implementing unit of the National Search and Rescue Agency (BASARNAS), plays a crucial role in conducting preparedness and rapid response efforts to emergency events in the region. Preparedness is a process that includes planning, training, resource mobilization, and an early warning system to minimize the risks and impacts of a disaster (BNPB, 2017) . According to Jufrizal et al.

(2023) , preparedness can be measured through indicators of knowledge and attitude, emergency response systems, early warning, and resource mobilization.

Various previous studies have discussed disaster preparedness, such as school preparedness for earthquakes (Indrasari & Kusuma, 2023) and SAR strategies for disaster management in coastal areas (Marlizar et al., 2023) . However, specific studies on the preparedness of SAR institutions in tourist areas prone to water accidents such as Parangtritis are still limited. This is where the novelty of this study lies, namely by analyzing the preparedness of the Yogyakarta Search and Rescue Office in a broad geographical and social context typical of the dynamic and complex Parangtritis beach.

However, most of this research still focuses on the preparedness of educational communities, communities, or broader institutional strategies, rather than on search and rescue (SAR) institutions in tourist areas with hazardous geographic characteristics. This creates a research gap: the limited scope of studies on SAR preparedness in high-traffic, water-accident-prone tourist destinations like Parangtritis Beach.

From these previous reviews, it is clear that most research still focuses on the preparedness of educational communities, urban communities, or broad institutional strategies, while specific research on the preparedness of search and rescue (SAR) institutions in tourist areas prone to water accidents with dangerous geographical characteristics is still very limited. This is the research gap: the limited study of SAR preparedness in tourist areas with high visitor intensity and a high risk of water accidents, such as Parangtritis Beach.

The novelty of this study is the comprehensive analysis of the preparedness of the Yogyakarta Search and Rescue Office using four preparedness indicators according to Jufrizal et al. (2023) , which are applied to the geographic and social context of Parangtritis Beach. Thus, this study not only assesses the preparedness from the internal perspective of the SAR agency but also considers the dynamics of the complex tourism environment, thus providing a more specific, applicable, and different picture than previous research.

Method

The type of research used in this study is descriptive qualitative, which aims to describe in depth the preparedness conditions of the Yogyakarta Search and Rescue Office in responding to accidents in the waters of Parangtritis Beach. The research data sources consist of primary data and secondary data. Primary data were obtained directly in the field through in-depth interviews, observation, and documentation. Interviews were conducted using a purposive sampling technique with key informants who have the capacity and

experience, namely the Head of the Operations and Alert Subsection, the Head of the Resources Subsection, rescuers, members of the SAR Region III Satlinmas, and local communities involved in emergency response activities. Non-participant observation was conducted to observe operational readiness in real terms, starting from the existence of alert posts, the availability of SAR equipment, to the high-risk geographical conditions of Parangtritis Beach. Documentation was used as a supplement in the form of activity reports, accident data, SOPs, activity photos, and safety socialization materials. Secondary data were obtained through literature studies, laws and regulations, SAR annual reports, and relevant previous research.

To ensure data validity, this study employed triangulation techniques, including source triangulation, technical triangulation, and time triangulation. Source triangulation was conducted by comparing information from various informants, technical triangulation was conducted by combining interviews, observations, and documentation, while time triangulation was conducted by collecting data in different situations, both on weekdays and during the holiday season, so that the data obtained was more accurate. All data were analyzed using the interactive analysis model of Huberman et al. (2014) which consists of three stages: data reduction, data presentation, and conclusion drawing and verification. In the data reduction stage, information from the field was selected and classified according to four preparedness indicators according to Jufrizal et al. (2023) , namely knowledge and attitudes, emergency response systems, early warning, and resource mobility. The simplified data were then presented in narrative form, tables, and interview excerpts for easier understanding. The final stage was drawing conclusions, which were carried out continuously with verification through triangulation, so that the research results could be scientifically accounted for.

Results and Discussion

Knowledge and Attitude of Yogyakarta SAR Office Personnel

Personnel knowledge and attitudes are fundamental aspects of preparedness for marine accidents. An interview with the Head of the Operations Section of the Yogyakarta Search and Rescue Office revealed that personnel preparedness is developed through three main approaches: technical training , physical development , and understanding the characteristics of marine areas . In his statement, he emphasized:

> "The mitigation measures we are taking include preparing personnel or rescuers with water-based assistance capabilities in accordance with the characteristics of the accident at Parangtritis Beach, such as boat rescue, physical and technical training, and scheduling 24/7 SAR alerts." (Head of the Operations Section of the Yogyakarta Search and Rescue Office, interview, 2024)

In addition to mastering rescue techniques, understanding *rip currents* and ocean trenches is also essential training material (Mutaqin et al., 2021) . The Head of Operations added:

> "In Parangtritis, we need to be wary of rip currents, or backwaters, and troughs. These troughs can be deceptive for tourists, appearing like land, but they can actually be very deep and cause drownings." (Head of Operations at the Yogyakarta Search and Rescue Office, interview, 2024)

Personnel readiness is further strengthened through routine training, both internally and across agencies such as the Indonesian National Armed Forces (TNI), the Indonesian National Police (Polri), the Regional Disaster Management Agency (BPBD), and the Search and Rescue (SAR) Community Protection Unit (Satlinmas). A member of the Yogyakarta Search and Rescue Office also confirmed that:

> "We regularly receive training, both internally and jointly with the Indonesian National Armed Forces (TNI), the Indonesian National Police (Polri), and the Regional Disaster Management Agency (BPBD). This is crucial for our preparedness in the event of emergencies in the waters." (Member of the Yogyakarta Search and Rescue Office , interview, 2024)

Despite limited personnel, a responsive attitude is still demonstrated through deployment at vulnerable points during the holiday season, as well as a commitment to education and coordination with the community (Yustiabel et al., 2014) . This aligns with the concept of *community engagement* in disaster management, which emphasizes collaboration between SAR institutions and local communities (BNPB, 2017) .

This level of preparedness is reflected in the following 2024 assessment data from the Yogyakarta Search and Rescue Office:

Table 1. Preparedness Recapitulation

Description	Mark	Weight	Achievement
Fulfillment of Routine Standby Officers	100	40%	40
Readiness of Infrastructure & Communication Tools	93.53	40%	35.53
Special Alert Officer	100	20%	20
Total Preparedness Index			95.53

Source: Yogyakarta Search and Rescue Office, 2024

The preparedness index of 95.53 reflects the agency's position in the good preparedness category. This assessment is based on three main aspects. First, the provision of routine standby personnel received a perfect score (100), indicating full, 24-hour, uninterrupted preparedness (Arianto et al., 2022) . Second, communication facilities and equipment received a score of 93.53, reflecting excellent condition, although they still require routine maintenance to maintain functionality. Third, in the special preparedness aspect, the agency again achieved a perfect score (100), indicating success in anticipating surges in tourists at certain times, such as national holidays or long holiday seasons. Overall, these three aspects demonstrate that the agency has a strong and responsive preparedness system.

However, limited personnel remain an operational challenge. Strengthening local capacity is a crucial strategy for enhancing preparedness, as reflected in the following training activities:

Table 2. Recapitulation of Potential Graduates Developed

Date	Material	Participant	Passed	Percentage
March 12–18, 2024	Water Rescue	50	50	100%
March 12–18, 2024	HART	50	50	100%
Total		100	100	

Source: Yogyakarta Search and Rescue Office, 2024

This activity marks the success of the Yogyakarta KPP in developing competent supporting human resources , including trained community members ready to assist in rescue operations. This approach reflects *the community-based disaster risk reduction* recommended by the UNDRR (2022) , where synergy between SAR teams and local communities creates a faster, more effective, and more adaptive response system to risks in coastal areas.

Emergency Response System

The Yogyakarta Search and Rescue Office (KPP) emergency response system is a key pillar in responding to marine accidents, particularly in vulnerable areas like Parangtritis Beach (Collins et al., 2021) . Based on interviews and field observations, this system was systematically designed through cross-sector coordination, implementation of Standard Operating Procedures (SOPs), equipment readiness, and post-operation evaluation.

1. Cross-Sector Coordination

Cross-agency coordination is the backbone of an effective response. In an interview, the Head of Operations for Basarnas Yogyakarta stated:

"We can't do SAR operations alone, so we've coordinated well in advance with relevant agencies so that when an incident occurs, a joint command post can be formed immediately and work synergistically." (Head of the Operations Section of the Yogyakarta Search and Rescue Office, interview, 2024).

This collaboration involved the SAR Unit of the Parangtritis Region III Community Protection Unit, the Yogyakarta Regional Police Water Police, the Navy Post (Posal), the Community Protection Unit (Samas), the Bantul Public Order Agency (Satpol PP), and various community SAR personnel. Communication was conducted via HT radio, cell phones, and field coordination meetings, as confirmed by a member of the SAR Unit:

"Coordination with Basarnas is very smooth. We usually contact them directly via radio or hold meetings in the field if there's a major incident." (Salahlinmas SAR member, interview, 2024)

This approach aligns with *the Integrated Incident Command System* (ICS) (FEMA, 2022) , which emphasizes the need for a unified command structure, clear communication, and flexible role allocation during emergencies.

2. Standard Operating Procedure (SOP)

The Yogyakarta Search and Rescue Office operates in accordance with the national Standard Operating Procedures (SOPs) issued by the National Search and Rescue Agency (Basarnas). These SOPs are designed to ensure a rapid, accurate, and coordinated response to any emergency. The procedure begins with the receipt of information regarding the accident, which is then verified and classified as A1 (valid) to ensure the report's validity. Once the report is confirmed, the next step is to submit it to the leadership for direction and approval. The SAR team is then dispatched to the incident location with an internal departure time standard of a maximum of 25 minutes after the report is received (Islamia et al., 2022) . Upon arrival, a joint post is established as an inter-agency coordination center, involving the Indonesian National Armed Forces (TNI), the Indonesian National Police (Polri), the Regional Disaster Management Agency (BPBD), volunteers, and the local Community Protection Unit (Satlinmas). The final stage of these SOPs is the implementation of search and rescue operations, with the principle of prioritizing the safety of both victims and rescuers.

The operational SOP flow of the Yogyakarta SAR Office can be described as follows: Information Receipt, incoming reports via the emergency call center (115) or

public reports. Verification & Classification, reports are verified and categorized A1 (valid). Reporting to the Leader, the leader provides direction and approval for the operation. Departure of the SAR Team, the team is dispatched with a standard response time of 25 minutes. Formation of a Joint Post, cross-agency coordination at the scene. Search & Rescue Operations, carried out with the priority of the safety of victims and rescuers.

The rescuer explained:

"Our standard operating procedures are standard. Once the information comes in, it only takes us 25 minutes to leave the office. However, travel time is still affected by distance and traffic conditions." (Member of the Yogyakarta Search and Rescue Office, interview, 2024).

The standard response time of 25 minutes indicates good initial readiness, although the geographical conditions and road access from the office to Parangtritis Beach (around 45–60 minutes) remain unavoidable operational challenges.

3. Equipment and Logistics Readiness

According to the Head of Resources, basic equipment such as *life jackets, ring buoys* , jet skis, surfboards, and jukung boats are available and routinely checked:

"Large boats are less effective on the south coast due to high waves and steep sea access. So we often use jet skis and small boats." (Head of Resources, Yogyakarta Search and Rescue Office, interview, 2024).

Equipment inspections were conducted before and after the standby period to ensure it was ready for use. However, the extreme terrain on the south coast means equipment like the *Landing Craft Rubber (LCR*) is rarely used. This finding aligns with the BNBP's disaster logistics principles (2021) , which emphasize the importance of facility and infrastructure readiness, routine maintenance, and equipment suitability to the area's characteristics to ensure effective emergency response.

4. SAR Operation Response Evaluation

Every SAR operation always concludes with a post-operational evaluation involving all elements of the joint team (Fadjri & Anggriani Jum, 2024) . This evaluation aims to assess various important aspects during the operation. First, the effectiveness of the response is the primary focus, determining the extent to which actions taken were able to address emergency needs quickly and appropriately. Second, inter-agency coordination is evaluated to identify strengths and potential improvements in cross-agency cooperation. Third, technical obstacles encountered in the field are recorded as material for improvement in future operations. Finally, feedback from the public is also collected as a

form of public accountability and as a consideration in improving the quality of SAR services going forward.

"We conducted a joint evaluation after the operation. The goal was to identify areas for improvement, including any challenges encountered in the field," explained a SAR officer (Member of the Yogyakarta Search and Rescue Office, interview, 2024).

This process reflects the *after-action review* (AAR) approach recommended by WHO (2019), namely a reflective process to improve the emergency response system in the future.

Early Warning

Early warning is a vital component of the coastal area's preparedness system for marine accidents, particularly in tourist destinations like Parangtritis Beach. Interviews with the Head of Resources and the Head of Operations at the Yogyakarta Search and Rescue Office revealed that this system has been implemented through a combination of technology and manual methods, adapted to local characteristics.

The strategies Implemented to mitigate and Improve tourist safety In coastal areas involve various coordinated approaches. First, warning signs and banners are installed at vulnerable points, such as *rip current zones* and ocean trenches, to provide visitors with visual information about potential hazards. Second, loudspeakers are regularly used to directly warn tourists to always be alert to sea conditions. Third, direct patrols by SAR and SAR Satlinmas personnel are routinely carried out to provide verbal warnings and directly monitor the situation. Fourth, intensive coordination is carried out with the Meteorology, Climatology, and Geophysics Agency (BMKG), referring to weather forecasts from the Yogyakarta Meteorology Station and BMKG Yogyakarta International Airport (YIA), to ensure an appropriate response to weather conditions. Fifth, information is also disseminated through social media and other digital channels that can be accessed in *real time* by the wider community, thereby increasing public awareness and preparedness for potential risks in coastal areas.

"We patrol during special alert periods like Christmas and New Year, but here we continue to collaborate with the SAR Satlimas Region III to patrol regularly and provide warnings directly on the beach. We've also placed noticeboards at vulnerable points. Information from the BMKG and the experiences of fishermen serve as our guide." (Member of the Yogyakarta Search and Rescue Office, interview, 2024)

The SAR standby post in the tourist area serves as a field coordination center and information dissemination center, as well as a reporting point for incidents. Close

collaboration is also established with the SAR Unit (Satlinmas) Region III, the Bantul Regency Regional Disaster Management Agency (BPBD), and the fishing community and surrounding community. However, interviews also revealed a number of challenges to the system's effectiveness, particularly during peak tourist season periods. A SAR officer from the Public Order Agency (Satlinmas) stated:

> "Cases of tourists ignoring warnings still frequently occur, even though they've been broadcast over loudspeakers or in person. Many don't realize how dangerous the waves are here." (Salammas Search and Rescue (SAR) member, interview, 2024).

Similar sentiments were echoed by local community respondents, who highlighted the need for improved multilingual communication and automated detection tools:

> "Foreign tourists sometimes don't understand warnings. There should be information in foreign languages and a real-time ocean current detection system." (local resident, interview, 2024)

Through field observations, several obstacles were identified that continue to hamper the effectiveness of safety efforts in coastal areas. First, the high level of tourist non-compliance with warnings issued through loudspeakers and direct intervention is a major challenge in reducing the potential for accidents. Second, the limited range of audio and visual warnings in large, crowded coastal areas prevents some tourists from receiving optimal information. Third, the limited use of modern technology, such as ocean current detectors or mobile app-based warning systems, also hinders the speed and accuracy of emergency responses. These obstacles highlight the need for strengthened technology-based safety strategies and more comprehensive and structured tourist education.

Resource Mobility

Resource mobility is key to the preparedness of the Yogyakarta Search and Rescue Office, encompassing aspects of human resources, equipment, logistics distribution, and operational strategies.

1. HR Readiness

   Yogyakarta Search and Rescue Office personnel possess good technical skills, having undergone regular training in areas such as *water rescue* , high-altitude rescue, and difficult-terrain evacuation. However, personnel are still limited, particularly during holidays or major incidents.

"We routinely train rescue teams, both physically and technically, such as in water rescue, HART, and the use of infrastructure. This training also involves potential SAR personnel such as SAR Satlinmas, Polair, Posal, etc., both through official Basarnas training programs and through independent training. This also includes joint simulations to achieve a common understanding in the field." (Head of the Operations Section of the Yogyakarta Search and Rescue Office, interview, 2024).

2. Facilities and Transportation Readiness

The Yogyakarta Search and Rescue Office has *rescue trucks* , jet skis, jukung boats, drones, and other equipment. The equipment is regularly inspected, but terrain and high waves limit the use of large vessels. Jet skis and jukung boats are more frequently used due to their greater adaptability.

"We have PPE, jet skis, and small boats ready. However, large boats or LCRs are difficult to use because the contours of the southern coast make access in and out very limited," explained a SAR officer (Member of the Yogyakarta Search and Rescue Office, interview, 2024).

3. Distribution and Mobilization Strategy

Personnel were deployed from the nearest point and focused on vulnerable areas during special alert periods such as Christmas and New Year holidays, as well as other major holidays. Furthermore, rapid coordination between agencies was also part of the optimization strategy. With an integrated communications system, the SAR team was able to streamline travel time and efficiently distribute equipment and logistics to operational points. Although the mobilization system had been designed, several obstacles remained , such as: extreme weather, high waves, and the distance from the Yogyakarta Search and Rescue office to Parangtritis Beach, which slowed access and rescue operations.

"We have a special standby here during the holiday season, and we have a 24/7 standby system. If we can't be on standby on the beach, we coordinate with the SAR (Satlinmas) and the Water Police for initial response," explained a SAR officer (Member of the Yogyakarta Search and Rescue Office, interview, 2024).

The Role of Community and Local Potential

The involvement of local communities and the potential of search and rescue (SAR) units, such as the SAR Satlinmas Region III, has been proven to significantly contribute to accelerating the response to maritime accidents. Community participation is not only reactive when an incident occurs, but also proactive in disseminating information, providing education, and providing first aid. This is confirmed by a statement from a member of the SAR Satlinmas Region III:

> "We are on standby at vulnerable points. When an incident occurs, we act immediately, use PPE, and if the situation is urgent, we immediately coordinate with Basarnas," (Satlimas SAR member, interview, 2024)

He added that support from the local community and fishermen was also very helpful in the search for victims. Local residents echoed this sentiment:

> "We here know the dangers of rip currents, troughs, and large waves. If we see someone swimming in a prohibited zone, we sometimes remind them. If we see someone being swept away, we quickly notify the officers or, if possible, we help them." (local community member, interview, 2024).

The concept of *community-based disaster risk reduction* developed by the National Disaster Management Agency (BNPB) (2022) is reflected in the role of the Parangtritis community. They possess local knowledge, the courage to act, and the social connections that enable rapid decision-making in emergencies. This aligns with Wisner et al.'s (2004) argument that local communities, when properly empowered, constitute the first line of defense against disaster risk. However, this participation is not yet fully facilitated by the formal system. Improved education, tiered technical training, and moral and material rewards are needed to ensure sustainable community involvement. Furthermore, the integration of their roles within the official emergency response system needs to be strengthened to prevent overlapping or conflicting authorities in the field.

Conclusion

This study concludes that the level of preparedness of the Yogyakarta Search and Rescue Office in dealing with water accidents at Parangtritis Beach is classified as good and systematic, as shown by four main indicators of Jufrizal et al. (2023): personnel knowledge and attitudes, emergency response systems, early warnings, and resource mobility. Personnel demonstrated strong technical skills and responsiveness, supported by regular training and an understanding of local characteristics such as *rip currents* and troughs. The emergency response system was structured through cross-sector coordination, clear standard operating procedures (SOPs), and equipment readiness, despite challenges related to terrain and personnel constraints. Early warning systems were implemented through various channels, both manual and digital, but their effectiveness was limited by visitor behavior and the lack of automated detection tools. Resource and equipment mobility was quite adaptive, but still affected by natural factors and logistical limitations.

The primary contribution of this research lies in strengthening the perspective of *community-based disaster preparedness* in coastal tourism areas, emphasizing integration

between search and rescue institutions and local communities. These findings broaden the understanding of preparedness based on field collaboration, making it relevant for application in other vulnerable areas in Indonesia. Going forward, this research opens up opportunities for developing theory and practice through comparative studies across coastal tourism areas, integrating IoT-based early warning technology, and developing a sustainable, incentive-based community engagement model. Thus, this study not only addresses current preparedness issues but also serves as a foundation for developing a more responsive and participatory disaster management system in the future.

However, this study also has several weaknesses. First, limited human resources and equipment prevented optimal field response. Second, the success of SAR operations still depended heavily on the behavior of tourists, who often ignored safety warnings. Third, the geographical conditions and distance from the SAR Office to Parangtritis Beach hindered achieving ideal response times. Fourth, the study's scope focused only on Parangtritis Beach, so the results cannot be generalized to other coastal tourist areas. To address these weaknesses, this study recommends several steps. The government needs to increase the number and capacity of search and rescue (SAR) personnel through permanent standby posts in vulnerable tourist areas. Modernization of infrastructure is also crucial, such as the installation of IoT-based ocean current sensors, digital early warning systems, and rapid evacuation equipment (Pangururan et al., 2015) . Tourist education programs should be strengthened with multilingual media and a persuasive approach based on local culture to encourage visitors to comply with safety regulations. Furthermore, local community involvement through training, regular simulations, and the provision of incentives and legal protection is also essential. Further research in other coastal tourist areas is needed to develop a more comprehensive and applicable preparedness model across Indonesia's diverse geographic regions.

Based on the conclusions presented, the researchers offer several recommendations to improve safety effectiveness in coastal tourism areas. First, the government needs to increase the number and capacity of search and rescue personnel by adding personnel and providing advanced training, particularly in vulnerable locations like Parangtritis Beach. Second, equipment and technology modernization is needed through investments in ocean current sensors, underwater sonar, and app-based monitoring systems to support more efficient search and rescue operations. Third, tourist safety education and campaigns should be strengthened, including through multilingual media and persuasive approaches to help visitors better understand the risks and comply with warnings. Fourth, developing the

potential of local communities is also crucial, by involving them in training and simulations, and providing incentives and legal protection for their active participation. Finally, comprehensive evaluations of emergency response systems, coordination, and training effectiveness should be conducted regularly to remain responsive to evolving challenges.

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