

Mapping the Routes and Staging Points of Cross-Border Crime in the Eastern Sabah Security Zone (ESS Zone), Malaysia, 2000-2023

Bee, B. B. B.,¹ Sakke, N.,² Ramli, I.,^{3*} Dollah, R.,⁴ Jafar, A.,² Joko, E. P.¹ and Jovita, H.⁵

¹History Program, Faculty of Social Sciences and Humanities, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia, E-mail: baszley@ums.edu.my, ekopravitnojoko@ums.edu.my

²Faculty of Social Sciences and Humanities, Geography Program, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia

E-mail: dinums@ums.edu.my, adi.jafar@ums.edu.my

³Faculty of Islamic Studies, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia

E-mail: issraq@ums.edu.my

⁴International Relations Program, Faculty of Social Sciences and Humanities, Universiti Malaysia Sabah, 88400 Kota Kinabalu, Sabah, Malaysia, E-mail: ramlid@ums.edu.my

⁵Department of Political Science, Mindanao State University – Iligan Institute of Technology (MSU-IIT), 9200 Iligan City, Philippines, E-mail: hazel.jovita@g.msuiit.edu.ph

*Corresponding Author

DOI: <https://doi.org/10.52939/ijg.v21i8.4359>

Abstract

The threat of cross-border crime (CBC) in the Sulu-Celebes sea is a persistent challenge, particularly along the eastern coast of Sabah, where it poses a significant risk to regional security. This paper advocates for the use of Geographic Information System (GIS) tools to visually represent and analyze the dynamics of CBC in the region. GIS mapping identifies five primary focal areas and 14 distinct routes that are critical to understanding the movement of illicit activities in the Eastern Sabah Security Zone (ESS Zone). Notably, high incident point such as the Sibutu/Sitangkau-Semporna and Sibutu/Sitangkai/Omapui-Kunak/Lahad Datu corridors account for 10 key CBC routes. Further analysis reveals approximately four additional major routes in areas like Bongao/Sibutu–Kinabatangan, Taganak/Bakungan–Sandakan and Mangsi–Kudat. Over two decades between 2000-2022, these maritime routes have been pivotal in facilitating CBC activities in Sabah's waters. This visual mapping provides valuable insights for security forces, empowering them to adopt proactive strategies to combat CBC. It aims to enhance understanding of geographical patterns and criminal tactics, informing strategic interventions to prevent and mitigate the threats of CBC in the region, thus contributing to broader regional security efforts.

Keywords: Cross Border Crime, Mapping, GIS, GPS, Malaysia

1. Introduction

Crime is a persistent and multifaceted threat that undermines the social fabric, political stability and economic development of any nation. While domestic crime poses significant challenges, cross-border crime (CBC) represents a more complex and transnational dimension of criminality that transcends national jurisdictions and defies conventional law enforcement mechanisms. CBC is particularly alarming in regions with porous borders, maritime vulnerabilities and overlapping territorial claims, where weak governance, socio-economic disparities and geopolitical contestations create fertile ground for illicit activities [1][2][3] and [4].

CBC encompasses a wide array of illicit activities, including human trafficking, drug smuggling, maritime piracy, arms trafficking, kidnapping for ransom (KFR) and wildlife smuggling [5]. These activities are often conducted by well-organized and decentralized transnational criminal syndicates (TOCGs) that exploit the institutional weaknesses of states and operate across borders with impunity [6] and [7]. According to Andreas [8], the deterritorialized nature of CBC exploits the gaps in jurisdiction, enforcement and interstate cooperation, allowing these groups to thrive in weakly governed spaces.

Friman and Andreas [9] further note that these networks are highly adaptive, shifting operations in response to state crackdowns to exploit emerging vulnerabilities. In doing so, CBC not only threatens individual safety and human security but also erodes state sovereignty, weakens governance institutions and undermines the rule of law [10].

In maritime Southeast Asia, the Sulu-Celebes Sea region, shared by Malaysia, the Philippines and Indonesia has long been identified as one of the world's vulnerable maritime corridors [11][12] and [13]. This area, characterized by porous maritime borders, historical trade routes and complex ethnic ties, provides ideal conditions for CBC operations [14][15][16] and [17]. Non-state actors including the Abu Sayyaf Group (ASG) have leveraged these historical and spatial dynamics, transforming from ideologically driven militants into profit-oriented criminals through kidnapping-for-ransom and smuggling operations [18][19] and [20]. These actors exploit kinship and trade networks across borders, often among stateless or migrants, complicating state efforts to secure the region [21][22][23] and [24].

As part of Malaysia's response, the Eastern Sabah Security Zone (ESS Zone) was established in 2013 following the Lahad Datu incursion. This initiative sought to bolster border security and deter maritime threats along Sabah's eastern seaboard. However, CBC networks continue to challenge the effectiveness of ESS Zone operations, due to the region's archipelagic geography and longstanding neglect of its borderlands [19] and [20]. The continued presence of such threats reflects the need to reassess conventional enforcement models in favor of multidimensional and regionally coordinated strategies. Moreover, CBC often intersects with terrorism, insurgency and irregular migration, forming a complex nexus of threats that blur the boundaries between crime and political violence [25][26] and [27]. This nexus is particularly evident in the Sulu-Celebes maritime corridor, where criminal actors and violent extremists often collaborate for mutual benefit, further complicating the regional security landscape [1][11][12][15][16] and [28]. In such cases, CBC is no longer simply a matter of policing but becomes a strategic and geopolitical issue that threatens not only local communities but regional stability as a whole.

Despite a growing body of literature on cross-border crime (CBC) typologies and socio-political drivers [29][30] and [31], relatively little scholarly attention has been paid to the spatial dimensions of cross-border criminality [32] and [33]. Studies indicate that CBC in the Sulu-Celebes Sea is enabled by a network of informal maritime routes, staging

points and island-based hideouts that are difficult to monitor and control [13] and [2]. From a spatially informed perspective, one movement patterns, operational hubs and logistical corridors can significantly enhance Maritime Domain Awareness (MDA) and the effectiveness of law enforcement responses [4]. Scholars such as Hastings [34] have stressed that spatial knowledge of maritime threats is crucial for designing targeted, adaptive and regionally coordinated policy interventions. In light of these developments, CBC must be understood not only as a criminal justice issue but as a broader regional and geopolitical challenge that requires coordinated, data-informed and cross-sectoral responses. The growing body of work on maritime security and border studies underscores the importance of a holistic approach, combining enforcement, socio-political reform and international cooperation to address both the root causes and operational mechanisms of CBC [2][4][17] and [35]. By combining spatial analysis with qualitative data from security personnel and local communities, this paper aims to enhance policy planning and operational readiness against cross-border threats. It offers valuable insights into how geography shapes security challenges and underscores the importance of integrated, data-driven responses to CBC in the Sulu-Celebes maritime region.

2. Methods

2.1 Study Area

Sabah is a state located on the third largest island in the world, Borneo. It shares land borders with Sarawak (Malaysia) and Kalimantan (Indonesia) and can be considered a maritime state since the sea surrounds it. Sabah is positioned between the South China Sea, Sulu Sea and Celebes Sea. Malaysia shares the Sulu Sea with the Philippines and shares the Celebes Sea with Indonesia. Almost one-third of Sabah's maritime border lies in these waters. Sabah has a sea area of 106,823 square kilometers, including its exclusive economic zone (EEZ). Its coastline is approximately 1,860 kilometers long, stretching from Tanjung Mengalong, Labuan to Pulau Sebatik, Tawau [36]. However, considering other geographical features (such as islands and lagoons), the coastline's length can reach up to 4,328 kilometers [37]. There are about 495 islands in Sabah, including sandbanks, although 280 of them still remain unnamed [36]. Geographically, Sabah occupies a strategically maritime position due to its location along important access routes to major shipping lanes in the Southeast Asian region.

With its extensive coastline, it boasts broad access to the South China Sea to the west, the Sulu Sea to the east and the Celebes Sea to the south, providing valuable access to key shipping lanes in the region. Sabah's maritime position offers numerous benefits and opportunities to become a vital center for trade, ports and logistics in the area. Ports such as Kota Kinabalu, Sandakan and Tawau serve as crucial gateways for maritime trade and shipping. Beyond serving as gateways to trade routes, this position also presents opportunities in the development of the tourism sector and marine resources. Sabah is renowned for its stunning coral reefs, breathtaking tropical islands and remarkable marine parks. It also possesses rich marine resources such as fish, shrimp and other seafood that are crucial for fishing and aqua-cultural industries [38].

The Eastern Coast of Sabah is a pivotal area due to its extensive coastline and the presence of numerous small islands along the Malaysia-Philippines border. It is estimated that there are 316 islands in the waters of ESSZONE [39] and around 7,641 islands in the Philippine waters [40]. This expansive maritime area fosters significant movement and cross-border activities, making it a hotspot for both legal and illegal maritime operations. The region's unique geographical conditions and strategic location create opportunities for various cross-border criminal activities, posing a significant threat to the stability and harmony between Sabah and the Philippines. The proximity of numerous islands, coupled with porous borders, facilitates illegal trade, human trafficking and other illicit

activities, undermining regional security and cooperation.

The vast and elongated maritime area is defined by the international physical boundaries between Sabah (Malaysia) and the Philippines. These boundaries are marked by the connection of 11 geographical coordinate points, as outlined in the New Map of Malaysia 1979. This map specifies Malaysia's maritime boundaries using geographical coordinates derived from Admiralty Charts No. 2660A and 2660B [41], as depicted in Figure 1. The spatial volatility and socio-economic activities along the border areas, culminating in the Tanduo intrusion incident in 2013, prompted the formal establishment of the Eastern Sabah Security Command (ESSCOM) on March 7, 2013 [42]. Its primary aim was to bolster maritime security control in Eastern Sabah and prevent any terrorist activities from occurring in Sabah's waters. To strengthen ESSCOM, the Eastern Sabah Security Zone (ESSZONE) was also launched on March 25, 2013. Initially, ESSZONE consisted of 10 districts [39], however, changes occurred after the boundaries were redrawn for the Beluran and Tawau districts. The Beluran district was divided into two, resulting in the creation of the Beluran and Telupid districts. Tawau underwent a similar division, forming the Tawau and Kalabakan districts. As a consequence of this redistricting, the ESSZONE area now encompasses the Tawau, Kalabakan, Semporna, Kunak, Lahad Datu, Sandakan, Kinabatangan, Beluran, Telupid, Kota Marudu, Pitas and Kudat districts (see Figure 1) [43].

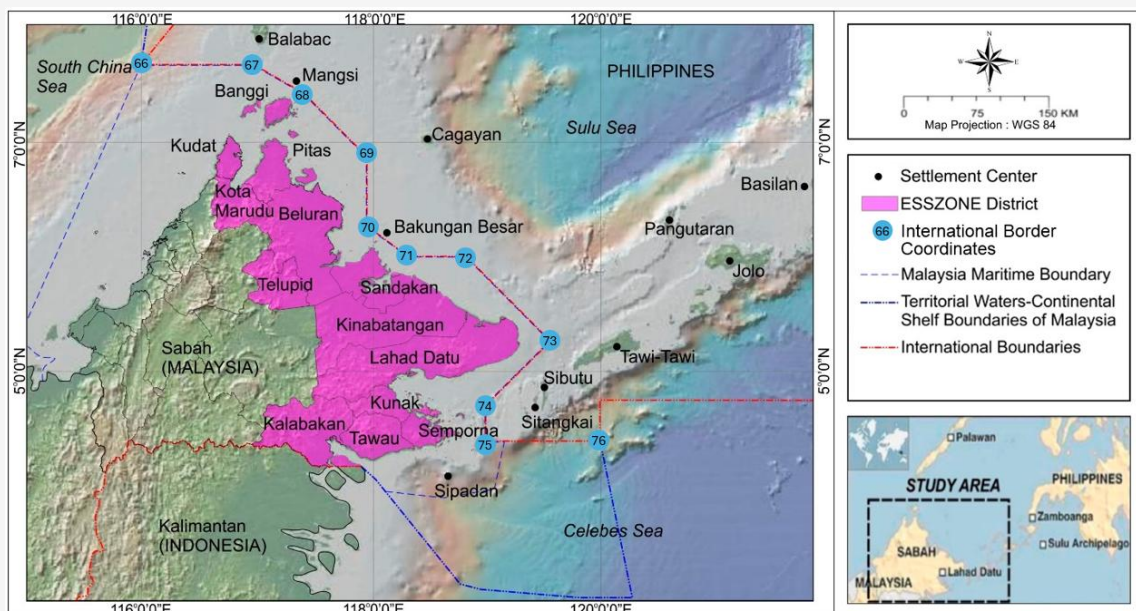


Figure 1: ESSZONE area and Philippines border [39][41][44] and [45]

The estimated land area is about 37,046 square kilometers (km²) [46], while the maritime area is approximately 54,420 km². The Lahad Datu district serves as the operational and administrative center of ESSCOM to safeguard the waters of ESSZONE, stretching over 1,773 kilometers [39][47] and [48].

2.2 Demographic Characteristics of the East Coast of Sabah

Studying the demographic characteristics of the East Coast of Sabah is essential for understanding the region's complex security challenges, as population dynamics are closely tied to issues such as cross-border crime, statelessness, smuggling, human trafficking and terrorism. Sabah (formerly North Borneo) shares a long historical and cultural connection with the southern Philippines, where centuries of migration, trade and intermarriage have fostered strong primordial sentiments and kinship ties among communities on both sides of the maritime border. However, the imposition of modern state boundaries, first by colonial powers and later with the formation of Malaysia in 1963 has disrupted these traditional ties, separating families and communities that once moved freely across the Sulu-Celebes Sea. These enduring bonds persist despite the border, often facilitating cross-border movement and mutual support among the ethnic groups [14]. Today, the presence of large migrant and stateless populations, many of whom maintain familial and emotional links across borders, complicates state security efforts in the Eastern Sabah Security Zone (ESSZONE). These demographic realities create vulnerabilities that are often exploited by transnational criminal networks and underscore the

need for a security approach that accounts for both the historical context and the socio-political dynamics of the borderland population [27].

The demographic makeup and population pattern of Sabah are unique due to its diverse ethnic composition and varied cultures. According to data from the Department of Statistics Malaysia, the population of Sabah has experienced significant growth in recent decades. In 2020, the population of Sabah was approximately 3.4 million compared to 0.7 million in 1970 [49]. The population growth rate of Sabah is one of the highest among the states in Malaysia. It is driven by various factors such as high birth rates and migration. Out of the recorded population of Sabah in 2020, 51.7% resided in the ESSZONE area, totaling 1.8 million people. This large population is attributed to the presence of major urban centers in the area. Sandakan district has the highest population with around 439,050 people, followed by Tawau (372,615 people), Lahad Datu (229,138 people), Semporna (166,587 people) and Kinabatangan (143,112 people). The population of other districts is less than 100,000 people, as shown in Table 1. In terms of citizenship, 32.1% of the ESSZONE population consists of non-citizens. In 2020, the Kinabatangan and Kunak districts had citizenship rates of less than 50%. Meanwhile, five other districts displayed citizenship rates of less than 70%. The five districts are Beluran (including Telupid), Sandakan, Lahad Datu, Semporna and Tawau (including Kalabakan). This indicates that the northern districts of Sabah, including Kudat, Pitas and Kota Marudu, continue to be locations where citizens are predominantly settled, as shown in Figure 2.

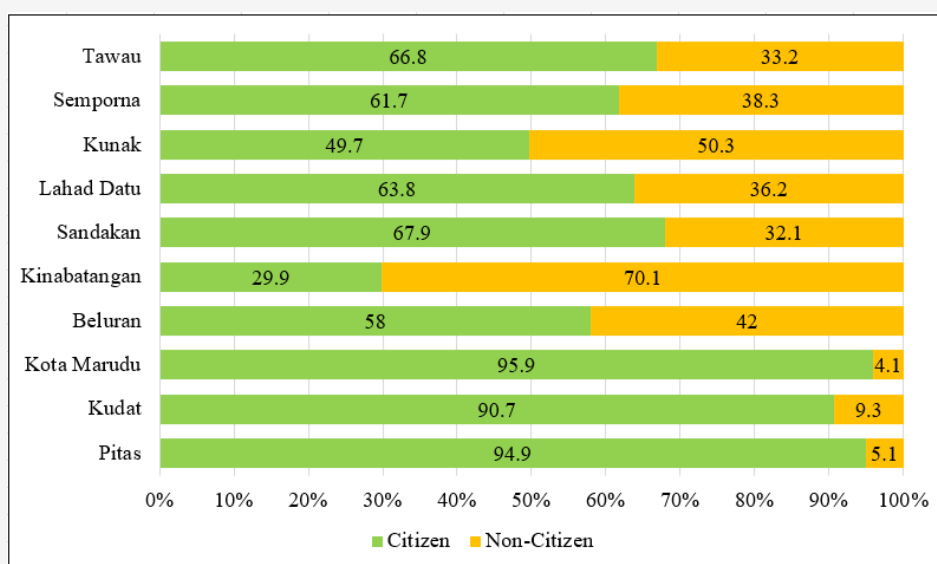


Figure 2: Percentage of non-citizens population in ESSZONE districts [49]

Table 1: Population density by ESSZONE districts [46][49] and [50]

No	District	Area (km ²)	Total population	Population density (people/km ²)
1	Pitas	1,419	36,660	26
2	Kota Marudu	1,916	69,528	36
3	Kudat	1,287	86,410	67
4	Beluran	5,498	77,125	14
5	Telupid	2,210	29,606	13
6	Sandakan	2,266	439,050	194
7	Kinabatangan	6,604	143,112	22
8	Lahad Datu	7,443	229,138	31
9	Kunak	1,134	68,893	61
10	Semporna	1,144	166,587	146
11	Tawau	2,240	372,615	166
12	Kalabakan	3,885	48,195	12
Total		37,046	1,766,919	48

In terms of population density, the entire ESSZONE region has a density rate of approximately 48 people per square kilometer (people/km²). Three districts have density rates consistent with their population numbers. Sandakan, Tawau and Semporna have population densities exceeding 100 people/km². Sparsely populated areas include Lahad Datu (31 people/km²), Kinabatangan (22 people/km²), Beluran (14 people/km²) and Kalabakan (13 people/km²). The presence of major town centers has attracted migration from neighboring countries, especially from the Philippines and Indonesia, allowing areas surrounding the cities to exhibit relatively high population densities [21] and [24]. Referring to Figure 3, urban centers such as Kudat, Kota Marudu, Pitas in the north, Sandakan in the east and the cities of Lahad Datu, Kunak, Semporna and Tawau in the south show population density patterns exceeding 100 people/km².

2.3 Crime Mapping: Distribution and Spread of CBC

Historically, the eastern coastal region has been a focal point of discussions between Malaysia and the Philippines, largely due to the presence of active separatist groups in Southern Philippines and various other security threats. These concerns have heightened tensions and shaped the diplomatic and security policies of both nations, as they work to address the challenges posed by insurgent activities and cross-border criminal operations in the area [2][12][16][20] and [51]. Among the recorded separatist groups in the region are the New People's Army (NPA), Jemaah Islamiyah (JI), Moro National Liberation Front (MNLF), Moro Islamic Liberation Front (MILF) and the Bangsamoro Islamic Freedom Fighters (BIFF) [28][16] and [27]. In addition to this, there are several other CBC groups and individuals that are considered threats by the Malaysian

government and are directly involved in activities in the Sulu Zone. These include smuggling syndicates, human trafficking networks that bring illegal migrants into Sabah, piracy and armed robberies, the Royal Security Forces (RSF), who were involved in the 2013 intrusion in Lahad Datu, as well as several other groups.

One of the most notorious of these groups is the Abu Sayyaf Group (ASG), an armed organization operating in Southern Philippines [3][4][16][17] and [31]. Initially, the ASG fought for the rights of Muslims in the Philippines, but over time, it became involved in criminal activities such as kidnapping for ransom, theft, drug trafficking and extortion to fund their activities [25] and [52]. The ASG transitioned from a purely terrorist organization to a criminal group due to shifts in leadership, membership, structure and alliances with both criminal and terrorist groups [26]. This transformation was particularly marked after the death of their main leader, Abdurajak Abubakar Janjalani, in 1998. His brother, Khadaffy Janjalani, who took over leadership, steered the group towards financial gain. Under Khadaffy's leadership, ASG began to focus on kidnapping for ransom, shifting their goals from establishing an autonomous state to securing financial resources to support their activities [3][19] and [31]. This shift led the ASG to expand their operations from Southern Philippines to the Eastern Coast of Sabah. In the initial phase of ASG's activities, criminal operations were primarily concentrated in the southern Philippines, with high incident point in regions such as Manila, Palawan, Sulu, Zamboanga, Basilan and Tawi-Tawi. However, by the early 2000s, these illicit activities began to extend beyond Philippine borders, spreading into neighboring Malaysia, particularly in Sabah, as depicted in Figure 4.

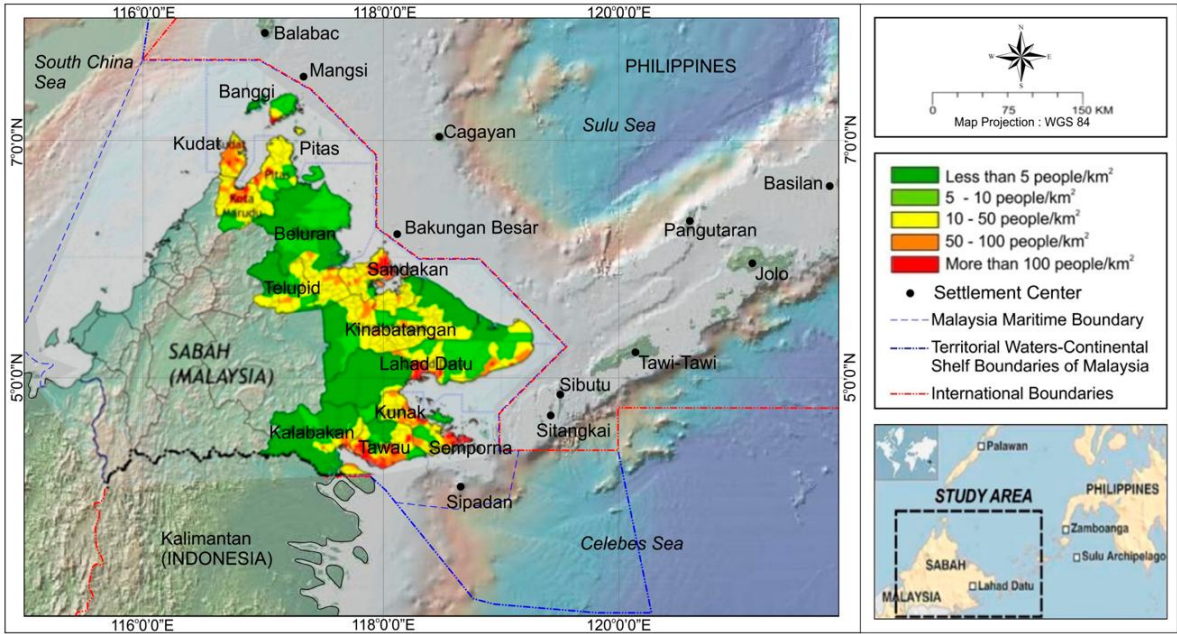


Figure 3: Population density in ESSZONE area [42][50] and [53]

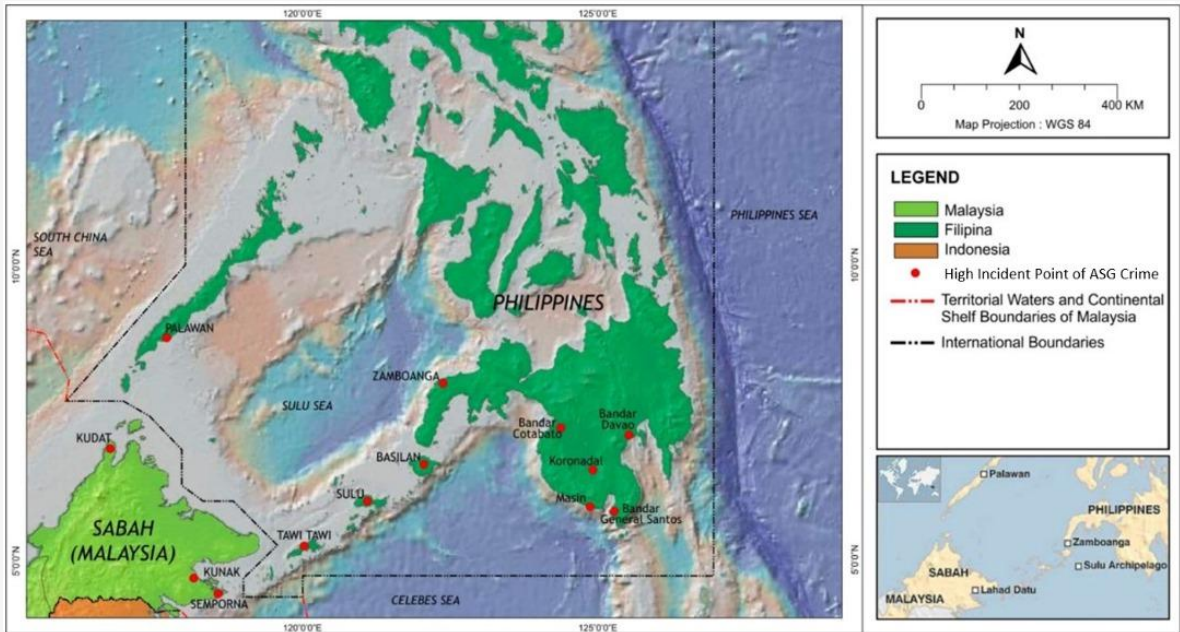


Figure 4: ASG crime involvement within towns and cities in Southern Philippines [19][25] and [31]

According to the Global Terrorism Database, the number of kidnappings in the Philippines has remained consistently high in recent years, but the number of victims increased by at least 70% between 2015 and 2016 (from 127 victims in 2015 to 218 in 2016). This number continued to raise in 2017, with a total recorded kidnapping/hostage incidents of 408. Figure 5 represents 4.6% of the total (8,937 victims)

recorded worldwide. While not all kidnappings by ASG in the Philippines are for ransom, the estimated total ransom collected exceeded USD35 million from kidnapping activities between 1992 and 2008 [13] and [19]. This substantial ransom collection makes it difficult to curb these activities since they can finance the expenses of CBC activities.

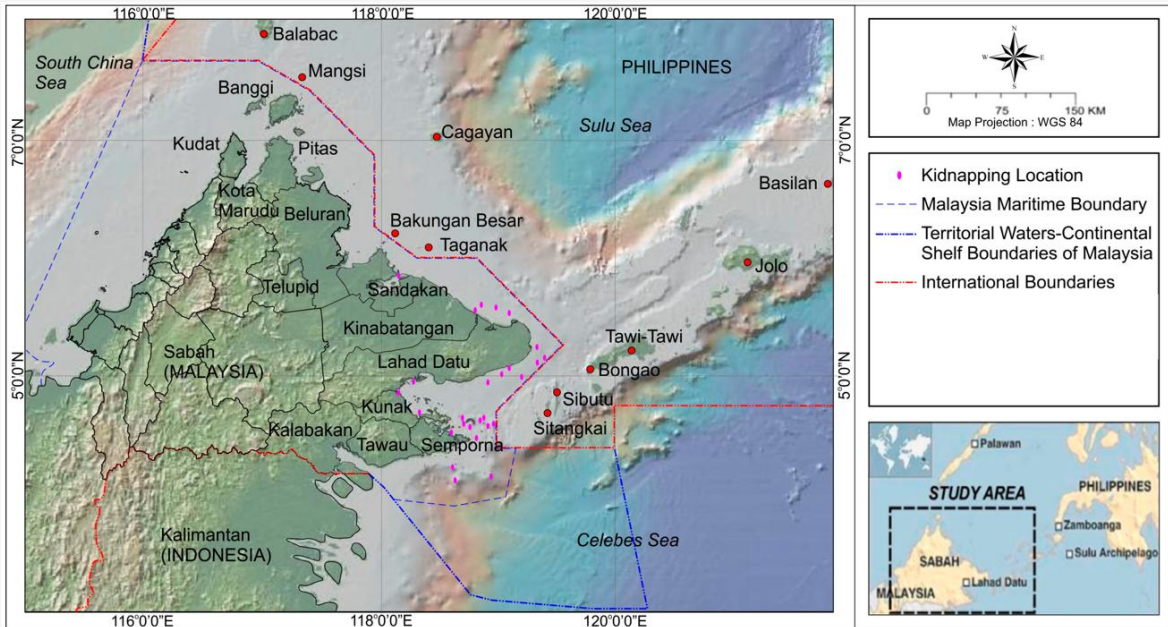


Figure 5: Locations of Kidnapping for Ransom (KFR) incidents on the East Coast of Sabah [19][27][39][47][48][54][55] and [56]

In the state of Sabah, particularly within the ESSZONE area, the patterns and trends of CBC activities vary across regions. Most of these activities are concentrated in the waters near the Sibutu/Sitangkai, Tawi Tawi and Basilan island chains. Between 2000 and 2024, Semporna District recorded the highest number of kidnappings, with around 13 incidents, followed by Lahad Datu (8), Kinabatangan (4) and one each in Kunak and Sandakan districts [39][47][48][55][56] and [57]. This data highlights that three districts, namely Semporna, Lahad Datu and Kinabatangan, serve as the focal points for CBC activities. Since the early 2000s, most CBC groups have concentrated their operations around the waters of Semporna and Lahad Datu, while activities in Kinabatangan started to emerge in 2016. In that year, there was a significant increase in kidnapping for ransom (KFR) incidents, particularly in Lahad Datu and Semporna, with four incidents each. Additionally, two incidents were reported in Kinabatangan waters. The focus of KFR perpetrators then shifted toward fishing vessels, particularly in the border waters of FELDA and Tambisan. This trend became more pronounced in 2018 and 2019, with new high incident point emerging near Pagasus Reef, Gem Reef and Felda Sahabat 16. However, as a result of various unilateral efforts by the Malaysian government, alongside bilateral and trilateral cooperation with neighboring countries to address these threats, no kidnapping incidents have been reported from 2021 to the present.

2.4 Data Acquisition

The data used in this study was collected from a combination of primary and secondary sources to ensure a well-rounded and comprehensive understanding of the issues surrounding cross-border crime in the Sulu Zone. The use of both types of data allowed for the triangulation of findings, providing a richer and comprehensive analysis of the region's security dynamics and criminal activities. For primary data, two key sources were utilized, namely the official and unofficial sources. The official data was primarily obtained from security agencies in Malaysia. This data acquisition involved both direct and indirect interactions with law enforcement and military personnel through presentations, seminars and interviews with officials [47][48][54] and [58]. Furthermore, this study also referred to official reports and documents, both published and unpublished, from Malaysian security agencies.

On the other hand, unofficial data was collected through a series of interviews with local stakeholders who are directly involved in or affected by the criminal activities in the region. These individuals included local residents of the coastal or islands in the ESSZONE and the Sulu Sea. For example, one of the interviewees was had first-hand experience as victims of kidnapping for ransom group [59]. Their personal testimonies provided critical, on-the-ground perspectives on how these crimes affect local communities. In addition, fishermen who rely on the Sulu Sea for their livelihoods were interviewed [60][61] and [62]. These individuals offered valuable

insights into the patterns of piracy and illegal fishing, smuggling, as well as the broader socio-economic impact of cross-border crime on their work. Another key group of sources were migrants, particularly those who regularly travel between the Philippines and Sabah [63][64][65][66][67] and [68]. Their experiences highlighted the vulnerability of transnational migrants to trafficking by criminal networks. Moreover, interviews were conducted with boat operators and smugglers, who, though often reluctant to speak openly, provided information on the modus operandi and major routes used for trafficking goods and people across borders [69] and [70]. These interviews with local residents, fishermen, migrants and others helped to contextualize the security-related data gathered from official sources, painting a fuller picture of how criminal activities are intertwined with the socio-economic and political realities in the region. These personal accounts offered valuable information and data to understand the issue of CBC in this area.

In addition to primary sources, secondary data played a significant role in supporting the findings and providing additional data and information to the study. A wide range of secondary resources were consulted, including library research. These books, journal articles and academic papers that focus on cross-border crime, maritime security and regional studies related to the Sulu-Celebes Sea were critical in providing a theoretical framework and a broader understanding of the issue. These sources offered well-researched historical accounts, as well as insights into the policies and interventions that have been implemented in the region over the years. Furthermore, online news articles and newspaper reports were reviewed to gather up-to-date information on ongoing issues. These sources provided timely data on the evolving nature of crime in the region, such as modus operandi by the CBC groups, the responses of the national governments and the effectiveness of multinational security efforts. By examining these diverse types of media coverage, the study was able to capture a range of perspectives.

To implement this crime mapping, the study employs a qualitative approach aimed at mapping in detail the routes and staging points of KFR incidents that occurred within the Eastern Sabah Security Zone (ESS Zone) between 2000 and 2022. This approach is essential for ensuring the robustness and reliability of the study's findings by triangulating information obtained from various sources, thereby enhancing the validity of pattern and location identification. The data collection process was carried out in a gradual and systematic manner.

The initial phase involved conducting semi-structured interviews with key respondents identified through the snowball sampling method. These respondents included individuals directly or indirectly involved in security operations, research or crisis management related to KFR. To ensure the accuracy and objectivity of the data, only information that demonstrated consistency and was supported by two or more respondents was recognized as valid. This process of cross-referencing information was fundamental to minimizing individual bias and verifying the accuracy of the data obtained. Google Earth was used to assist respondents in identifying the routes and staging points of the KFR incidents, enhancing the spatial reliability of the data.

The second phase of data collection focused on secondary information obtained from a series of official briefings conducted by relevant authorities, particularly the ESSCOM. The information from these briefings was cross-checked and validated against the interview data. This matching process aimed to confirm the locations of identified staging points and routes, while also identifying any discrepancies or significant additions. Additionally, a comprehensive literature review was conducted, involving an in-depth analysis of academic papers, research reports and both local and international news articles directly related to KFR incidents in the ESS Zone. These sources provided valuable historical context, detailed accounts of individual incidents and early indicators of KFR locations or patterns. The literature served as both a complement to and a verification of the data obtained from interviews and briefings.

2.5 Crime Mapping

To analyze the data, crime mapping serves as a critical tool for understanding complex criminal activities, particularly those involving transnational networks such as kidnapping for ransom (KFR). By providing spatial and visual representations, crime maps help analysts and enforcement agencies a visual-graphic representation of crime-related issues and help in the understanding of where and why crimes occur. This geographic perspective is especially valuable in identifying routes and staging points, offering insights into patterns that may be obscured in purely textual or tabular data. For law enforcement, crime mapping enhances operational effectiveness by pinpointing high incident point and movement networks, thereby supporting more targeted interventions. For policymakers, these maps provide strategic overviews that aid in long-term security planning and cross-border cooperation.

Crime maps are widely recognized for their three core functions: analytical visualization, spatial pattern identification and operational decision-making support [35]. In this study, crime mapping was employed to illustrate the routes and staging points of KFR activities across the ESS Zone. All validated data from the three primary sources, informants interviews, security agencies briefings and the literature review, were systematically integrated into ArcGIS software to establish a foundational spatial database of CBC-related locations. The data preparation began with the conversion of ArcGIS vector files (*.shp) into Google Earth-compatible formats (*.kml). Using Google Earth, each identified KFR staging point was plotted and visualized. These individual points were then connected using polylines, based on cross-referenced findings from interviews, official briefings and secondary sources, to represent the specific routes used during KFR incidents. The length of each polyline, representing the distance of each route, was measured and recorded in kilometers.

To preserve spatial accuracy and map scale, each map in ArcGIS shapefile format (*.shp) was exported as raster graphics (*.jpeg). These raster maps were then imported into presentation and graphic design software (Microsoft PowerPoint) to enhance visual clarity and integrate additional notations (Refer Figure 6). The resulting composite maps displayed the movement patterns and spatial structure of KFR activities, offering an informative and accessible format for analysis and communication. These maps serve as powerful analytical tools, allowing for a deeper understanding of the spatial dynamics of

cross-border criminal activity. They reveal patterns and linkages that are often not apparent through traditional non-spatial methods. Ultimately, the visualizations produced through this methodology are expected to play a significant role in informing security strategies, resource deployment and inter-agency coordination efforts aimed at strengthening maritime and border security in the ESS Zone.

3. Result and Discussion

3.1 Cross-Border Crime Routes

The expansive and strategically significant maritime area between Sabah and the Philippines serves as a conduit for CBC activities, extending into the waters of Eastern Sabah via multiple staging points and routes. These routes and staging points not only enable CBC groups to enter Sabah, particularly along its eastern coast, with ease while evading detection by security forces, but also facilitate their escape to maritime territories, particularly to the Philippines [44] and [19]. Based on the sources, there are 9 staging points: Pulau Balabac, Mangsi, Kagayan, Taganak, Bakungan Besar, Basilan, Jolo, Tawi Tawi and Sibutu/Sitangkai. Staging points Balabac and Mangsi are located near the Pitas-Kudat area, while Kagayan/Mapun, Taganak and Bakungan Besar are near the Sandakan area. The staging points of Basilan, Jolo, Bongao, Tawi-Tawi and Sibutu/Sitangkai are near the Lahad Datu and Semporna areas [19][39][47][48][54][55][56][57][59][60][61][62][63][64][65][66][67][68][69] and [70]. The positions of these staging points are displayed in Figure 7.

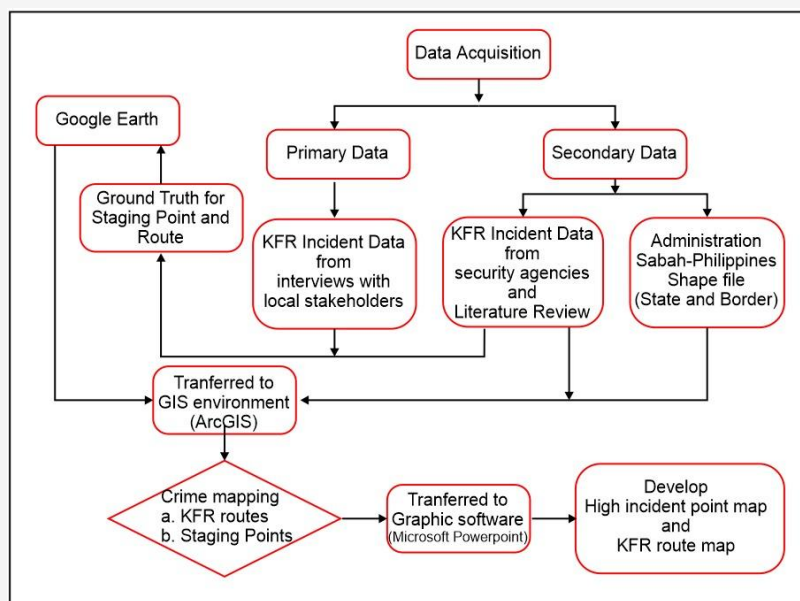


Figure 6: Developing the Crime Mapping Workflow

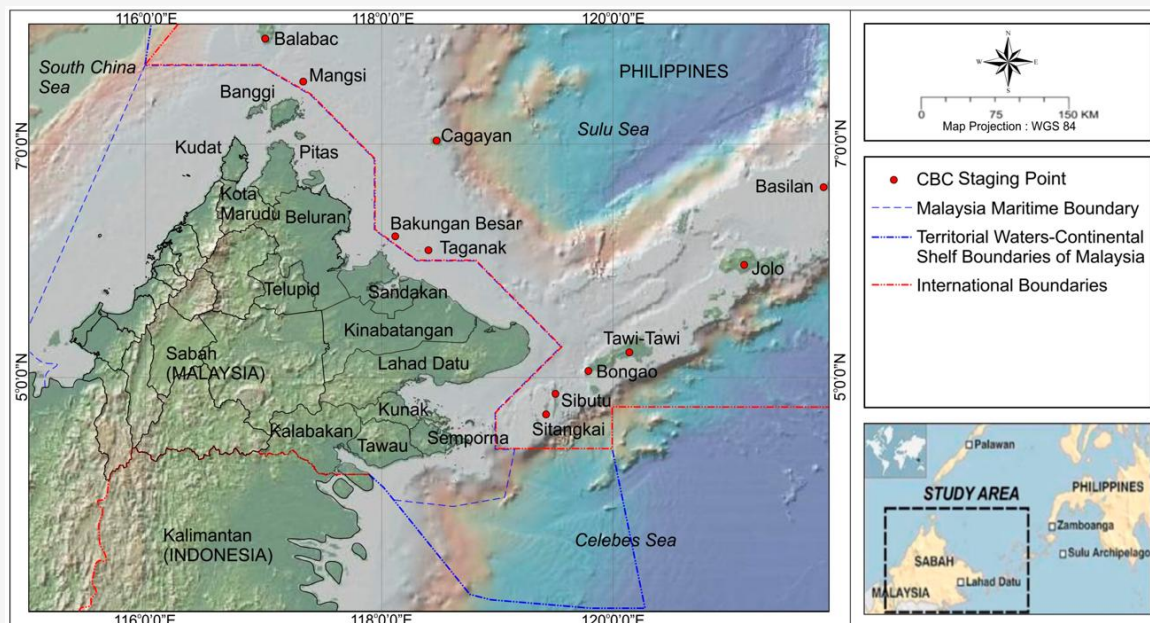


Figure 7: Staging points for CBC activities in Southern Philippines [19][39][47][48][54] [55][56][57][59] [60][61][62][63][64][65][66][67][68][69] and [70]

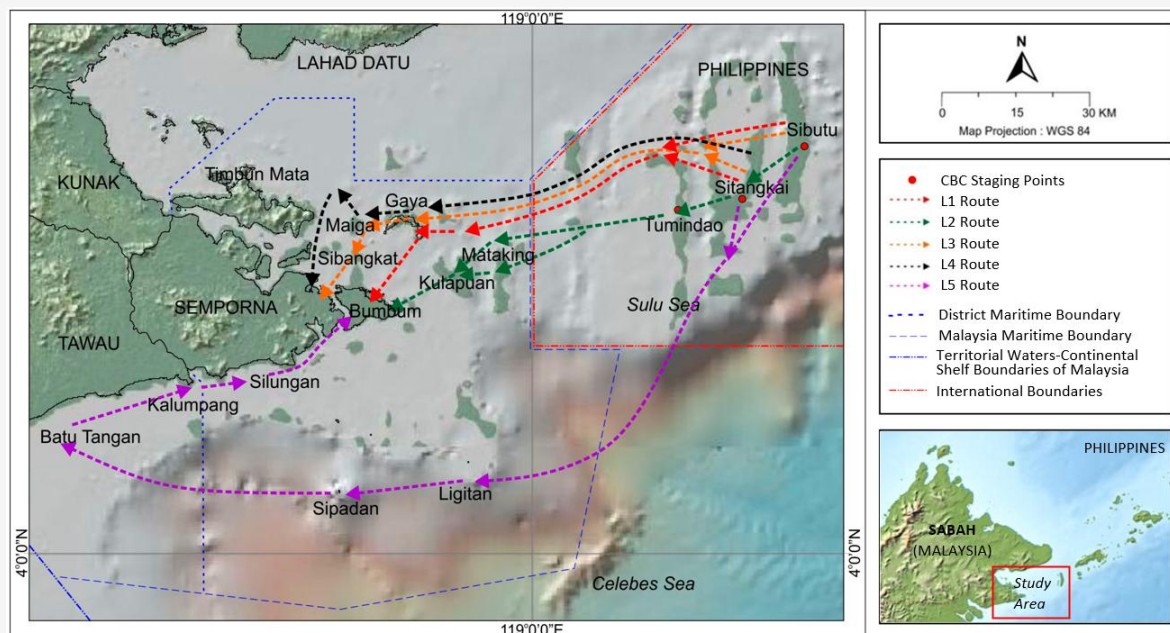


Figure 8: Routes of CBC groups between Semporna and Southern Philippines

For the waters of Semporna, the Sibutu/Sitangkai Islands in the Philippines serve as the main staging points for CBC activities. There are several transit islands in Philippine waters that are in close proximity to Matakang Island, Malaysia. These include Andulinang (39.5 km), Tuminando/Sitangkai (53.2 km), Omapui (60.8 km), Saluag (57.3 km) and Sibutu (63.4 km). From these staging points, CBC groups enter the waters of Semporna, Sabah through

5 main alternative routes before setting foot on the mainland of Semporna, as shown in Figure 8. Route L1 is estimated to be 100.3 km long, covering transit areas north of Pom-pom Island through the south of Bohey Dulang Island and onward to Semporna. Route L2, estimated at 95.6 km, includes Matakang Island and Timba-Timba Island via Kulapuan Island before reaching Semporna.

Table 2: Alternative routes of CBC groups entering the Semporna District [19][39][47][48][54][55][56][57][59][60][61][62][63][64][65][66][67][68][69] and [70]

Route	Staging points	Estimated distance (km)	Features
L1	Sitangkai/Sibutu → Pulau Pom-pom → Pulau Bohey Dulang → Semporna	100.30	Islands
L2	Sitangkai/Sibutu → Pulau Matakang and Pulau Timba-Timba → Pulau Kulapuan → Semporna	95.60	Islands
L3	Sitangkai/ Sibutu → Pulau Mantabuan → Pulau Gaya → Pulau Maiga → Pulau Sibangkat → Semporna	107.10	Islands
L4	Sitangkai/ Sibutu → Pulau Mantabuan → Pulau Gaya → Pulau Maiga → Pulau Sibuan → Semporna	115.80	Islands
L5	Sitangkai/Sibutu → Pulau → Pulau Sipadan → Perairan Batu Tangan → Pulau Kalumpang /Silungan → Terusan Tando Bulong → Semporna.	258.30	Islands, Canals

Table 3: Alternative routes for CBC groups entering the Kunak-Lahad Datu Districts [19][39][47][48][54][55][56][57][59][60][61][62][63][64][65][66][67][68][69] and [70]

Route	Staging points	Estimated distance (km)	Features
L6	Sitangkai/ Sibutu → Pulau Mantabuan → Pulau Gaya → Pulau Maiga → Pulau Sibuan → Kunak	144.4	Islands
L7	Sitangkai/ Sibutu → Pulau Mantabuan → Pulau Gaya → Pulau Maiga → Pulau Sibuan → Lahad Datu	146.1	Islands
L8	Bongao → Tg. Labian → Tambisan → Lahad Datu	105.5	Islands, Coastlines
L9	Sitangkai/ Sibutu → Omapui /Andulinang → Tg. Labian → Lahad Datu	65.7	Islands, Coastlines
L10	Sitangkai/ Sibutu → Omapui /Andulinang → FELDA Sahabat → Lahad Datu	64.1	Islands, Coastlines

Route L3 spans approximately 107.1 km, covering Mantabuan Island through Gaya Island, Maiga Island and Sibangkat Island. Route L4, at a distance of 115.8 km, covers Matabuan Island via Gaya Island, moving to Maiga Island and then to Sibuan Island. Route L5 is the last alternative route and takes a longer time. The estimated distance is around 258.3 km. It includes Ligitan Island via Sipadan Island, moving to the waters of Batu Tangan near the Tawau area and onwards to Kalumpang Island at the mouth of Kalumpang River or to Silungan Island. It enters Semporna through the Tando Bulong Channel. This channel is located between Bum-Bum Island and the mainland of Semporna. Details of these routes are provided in Table 2. For CBC activities in the Kunak and Lahad Datu districts, two staging points are located in the Sibutu/Sitangkai archipelago and Bongao in the Tawi-Tawi Islands. For the Kunak District, the location is quite far from the Philippine staging points, estimated to be around 129.4 km away. Therefore, most CBC have to cross the waters of Semporna through the same direction as indicated in the Route L4. Along this route, after transiting at Sibuan Island, some CBC perpetrators do not proceed to Semporna but choose Kunak district as their destination. Their route is shown in Figure 9 via Route L6.

The estimated distance for Route L6 is about 144.4 km. There are also movements to Lahad Datu using this route (L4), where after transiting Sibuan Island, the perpetrators enter the waters of Lahad Datu and transit in the area near Sakar Island, as shown through Route L7. The estimated distance for L7 is about 146.1 km. Apart from Route L7, three other routes are used to enter the Lahad Datu District without passing through the waters of Semporna. These include Routes L9 and L10, which also start from Sibutu/Sitangkai Islands through transit at Omapui/Andulinang Island. From Omapui/Andulinang Island, CBC activities enter the waters of Lahad Datu towards Tanjung Labian (Route L9 with an estimated distance of 65.7 km) or to the FELDA Sahabat cluster through Route L10 (estimated distance of 64.1 km). There is one more route that does not use the Sibutu/Sitangkai archipelago as a staging point. This route starts from Bongao, Tawi-Tawi Islands, through Route L8. Route L8 is estimated to be about 105.5 km long, covering transit at Tanjung Labian and moving towards Tambisan Island. Details of routes and movements are shown in Figure 9 and Table 3. For CBC activities in the Kinabatangan district, two staging points are utilized: the Sibutu/Sitangkai islands and Bongao in the Tawi-Tawi Islands.

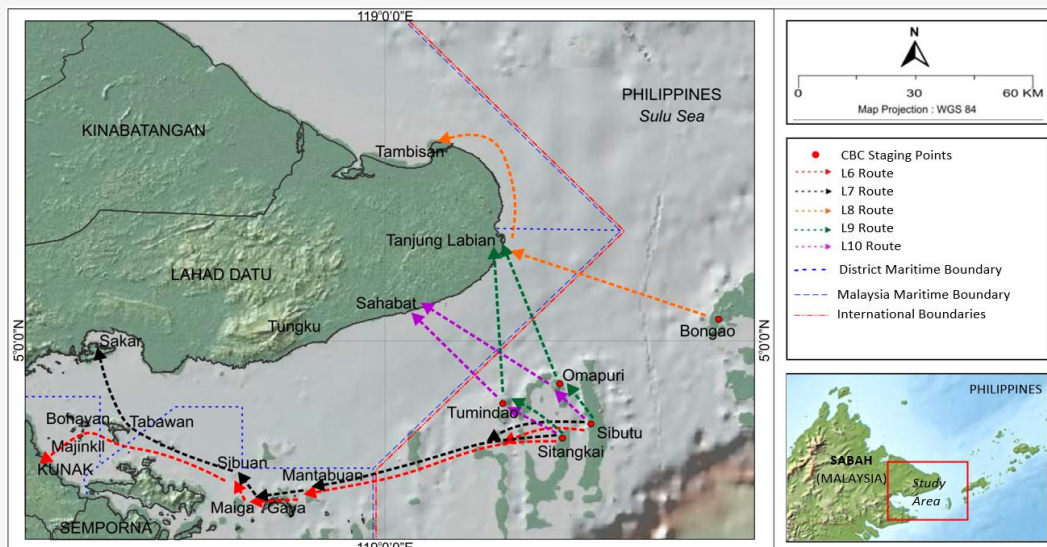


Figure 9: Routes for CBC activities between Kunak/Lahad Datu-Southern Philippines

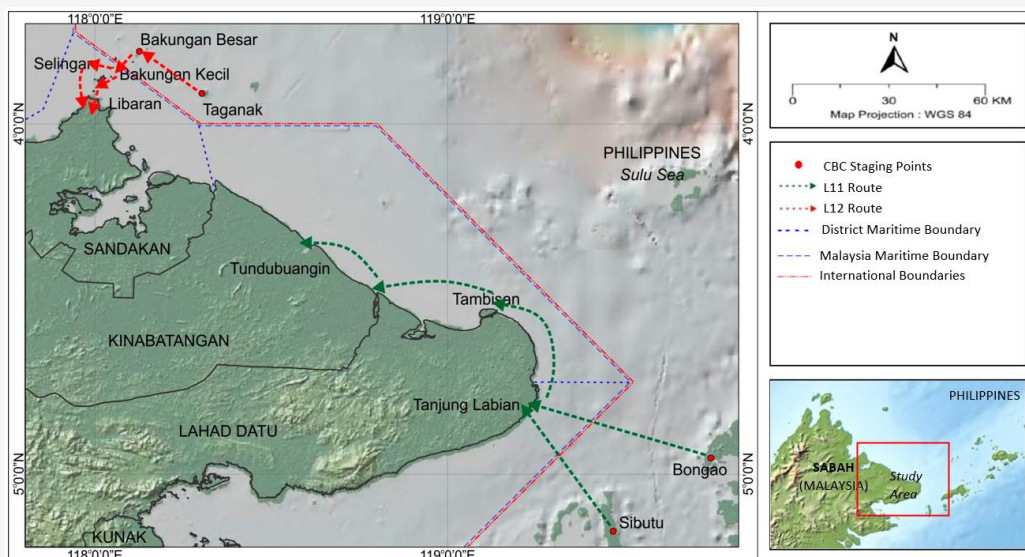


Figure 10: Route of CBC activities between Kinabatangan/Sandakan-Southern Philippines

To reach the Kinabatangan district, the same routes are shared with the Lahad Datu district via Routes L8 and L9. From Pulau Tambisan in the waters of Kinabatangan, CBC operatives will enter Kinabatangan through river mouths, especially in the Tundubuengin area, via Route L11. The estimated distance is approximately 167.1 km. To enter the Sandakan District, several locations are used before reaching the staging points of Pulau Tandanak and Bakungan Besar. These include Balabac in Palawan, Sulu and Basilan islands. The estimated distance from the starting point at Pulau Tandanak to Sandakan is about 48.1 km via Route L12. Bakungan Besar (owned by the Philippines) serves as the final transit before crossing the international border to Pulau Bakungan Kecil (owned by Malaysia).

From Bakungan Kecil, CBC perpetrators will head to Pulau Selingan or Pulau Libaran before landing on mainland Sandakan. The estimated distances from the staging point of Bakungan Besar to the transit areas in Sabah are Bakungan Kecil (2.5 km), Selingan (6.7 km), Libaran (13.6 km) and Pantai Layag-Layag which is on the mainland of Sandakan (19.1 km). Details of routes and movements are shown in Figure 10 and Table 4.

For CBC activities in the Kudat district, the staging point utilized is Pulau Mangsi. Most perpetrators use this staging point from the Palawan islands in Northern Sabah where the distance from Balabac Island (Palawan) to Pulau Banggi (Malaysia) is approximately 70.1 km. Starting from the staging point of Pulau Mangsi (owned by the Philippines),

CBC perpetrators enter Malaysian waters and transit at Pulau Mangsi Besar (owned by Malaysia). The perpetrators have two options, either to go through Pulau Banggi or to Pulau Balambangan. Through these two islands, located in Northern Sabah, the perpetrators will enter Kudat. The estimated distance of Route L13, from Pulau Mangsi Kecil to Pulau Mangsi Besar via Pulau Banggi, is approximately 87.9 km; while the estimated Route L14, from Pulau Mangsi Kecil through Pulau Balambangan, is around 89.8 km. Details of the routes and movements are shown in Figure 11 and Table 5. The findings from this study provide valuable insights into the spatial behavior and evolving strategies of CBC networks in Eastern Sabah.

Using GIS and qualitative triangulation, this research identified several major routes and multiple staging points used by CBC groups to penetrate Sabah's maritime boundaries. These results reveal that CBC is not a random or opportunistic phenomenon but rather follows systematic and historically embedded patterns of movement, a finding that aligns with Warren's (1985) conception of the "Sulu Zone" as a fluid maritime corridor shaped by centuries of trade, migration and conflict. The persistent use of these old routes, such as the Sibutu-Semporna corridor, highlights how CBC actors strategically exploit geographical familiarity, historical trade networks and weak maritime governance to facilitate their operations.

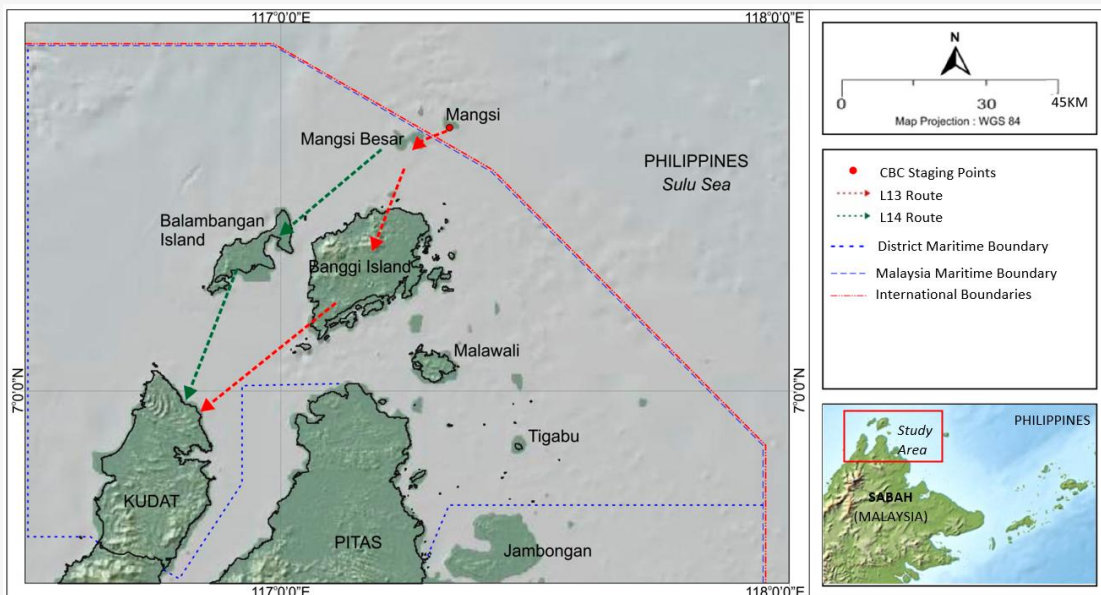


Figure 11: Route of CBC activity between Kudat-Southern Philippines

Table 4: Alternative routes for CBC groups entering the Kinabatangan/Sandakan region [19][39][47][48][54][55][56][57][59][60][61][62][63][64][65][66][67][68][69] and [70]

Route	Staging points	Estimated distance (km)	Features
L 11	Bongao/ Sibutu → Tg. Labian → Tambisan → Kinabatangan	167.10	Islands, Coastline, River Estuaries
L 12	Pulau Tanganak → Bangkungan Besar → Bangkungan Kecil → Selingan / Libaran → Sandakan	48.10	Islands, Coastlines

Table 5: Alternative routes for CBC group entering Kudat-Southern Philippines [19][39][47][48][54][55][56][57][59][60][61][62][63][64][65][66][67][68][69] and [70]

Route	Staging points	Estimated distance (km)	Features
L 13	Pulau Mangsi Kecil → Pulau Mangsi Besar → Pulau Banggi → Kudat	87.9	Islands
L 14	Pulau Mangsi Kecil → Pulau Mangsi Besar → Pulau Balambangan → Kudat	89.8	Islands

These routes, once used for legitimate trade and cultural exchanges between communities in the Sulu Archipelago and the eastern coast of Sabah, have evolved into informal but well-established pathways for the trafficking of goods, people and CBC. The continued reliance on such corridors suggests that CBC actors are not merely opportunistic, but highly adaptive and embedded within the spatial and socio-cultural landscapes of the maritime borderlands [11][14][17] and [71].

This reinforces what Banlaoi [31] described as the criminal utility of maritime geography, where geographical familiarity, porous borders and difficult-to-monitor maritime terrain are exploited by cross-border criminal actors to sustain illicit activities. These patterns also echo the spatial dynamics described by Liss [2], who argued that the porous maritime boundaries of Southeast Asia facilitate transnational criminal fluidity or what Rabasa and Peters [11] termed ‘ungoverned territories’, particularly in regions with weak enforcement, complex jurisdictional overlaps and strong social interconnectivity among border populations. Similarly, Chalk [1] referred to this condition as the Gray Area Phenomenon (GAP), describing regions where state authority is weak, contested or absent, thus allowing non-state actors such as criminal syndicates, insurgents, terrorists and smugglers to operate with relative freedom. These spaces are characterized by blurred distinctions between crime, terrorism and insurgency, creating complex security threats that are difficult for conventional state mechanisms to address. Indeed, the Sibutu-Semporna corridor's strategic location, linking southern Philippines to Sabah via narrow straits and island chains, provides CBC actors with multiple entry and exit points, natural cover and a population base familiar with cross-border movement. The region's fluid identities, familial ties across borders and long history of informal trade further reduce the friction and visibility of illicit activities [21]. Such maritime geography allows criminal networks to operate with relative impunity, exploiting both topographical advantages and the limited enforcement capacity of regional states [27]. In this context, geography is not just a passive backdrop but an active enabler of transnational crime, shaping both the strategies of criminal actors and the constraints faced by security forces. Thus, understanding the persistent use of these old routes is essential to any effort aimed at curbing maritime CBC. It demands a spatially informed security approach that accounts for the historical, cultural and physical geography of the region, as well as the enduring resilience and adaptability of criminal networks operating within it.

A major contribution of this study lies in its use of crime mapping to visualize the operational logic of CBC. The identification of hot zones such as Semporna, Lahad Datu and Kinabatangan supports prior studies by Asis [19][44][20][72] and [73] among other who noted that these areas have consistently experienced CBC. The maps produced through this study offer concrete illustrations of how CBC groups navigate space, using islands as transit hubs and avoiding conventional maritime patrol routes. This supports [35], who emphasized that GIS tools enhance law enforcement's strategic responses by revealing spatial concentrations and movement patterns that are not otherwise visible. Furthermore, the research reveals that ASG and affiliated criminal groups have undergone a transformation from politically motivated insurgents to profit-seeking criminal enterprises, consistent with findings by [25][26][16][28] and [74]. This “criminal-terrorism convergence” is reflected in the monetization of KFR operations and the extension of their activities into Malaysian waters, highlighting the blurring of ideological and economic motivations in CBC operations [4] and [25].

The study also found that the cessation of reported KFR cases after 2021 corresponds with intensified bilateral and trilateral security initiatives, including coordinated patrols under the Trilateral Cooperative Arrangement (TCA) between Malaysia, Indonesia and the Philippines [18] and [20]. While this suggests that state-led enforcement efforts have had measurable impact, it also raises the possibility of displacement effects whereby CBC groups shift operations to less-policed or lower-risk areas [3] and [12]. For example, new potential entry points were identified in Kudat and Kalabakan, which have historically seen lower CBC activity. This underscores the adaptive strategies employed by CBC actors and confirms that criminal networks exhibit high spatial intelligence and flexibility in the face of enforcement pressures [4]. Moreover, the socioeconomic context of the ESS Zone plays a significant role in shaping local security dynamics. This study finds that areas with larger non-citizen populations, informal settlements and fluid labor mobility tend to experience greater exposure to cross-border criminal activities. This observation aligns with the findings of [27], who highlight the complex interplay between irregular migration, economic vulnerability and security risks. Importantly, these socio-political conditions reflect broader structural challenges that can inadvertently create opportunities for criminal networks. They also underscore the limitations of security interventions that do not sufficiently engage with local realities and community contexts.

On a theoretical level, the study reinforces the relevance of critical geopolitics and political ecology in analyzing maritime security. The sea is not just a neutral space, it is contested, politicized and exploited by both state and non-state actors [75][76] and [77]. Therefore, from a policy perspective, the findings underscore the need for an integrated and multi-level approach to maritime security. Beyond tactical enforcement, long-term solutions must include community engagement, maritime domain awareness, intelligence sharing and regional cooperation. The use of GIS-based crime mapping, as shown in this study, should be institutionalized within agencies like ESSCOM to enable predictive policing and data-driven interventions [35]. Finally, this study contributes to the broader literature by offering an empirical and visual analysis of CBC in a region that is often underrepresented in global security studies. By combining spatial data with grounded testimonies and official briefings, it bridges the gap between quantitative mapping and qualitative insight, offering a holistic understanding of CBC in the Sulu-Celebes maritime complex.

4. Conclusion

This study set out to investigate the spatial dynamics of CBC along the eastern coast of Sabah, Malaysia, focusing on the mapping of routes and staging points used by CBC networks between 2000 and 2022. Using GIS and triangulated qualitative data from interviews and security briefings, the research aimed to visualize and analyze how CBC groups move across the Sulu-Celebes maritime region, with particular attention to KFR and other illicit activities. The findings reveal that CBC operations are highly structured and geographically patterned, relying on a network of legacy maritime routes, strategic island staging points and evasive tactics that exploit Sabah's vast and porous coastline. Key high incident point including Semporna, Lahad Datu and Kinabatangan serve as entry corridors for these groups, with staging points in southern Philippines such as Sibutu, Sitangkai and Bongao playing a crucial role in facilitating access. The mapping of primary routes and numerous transit islands illustrates the complex logistical frameworks employed by CBC actors.

These findings reaffirm the enduring relevance of historical maritime networks and the adaptive nature of modern criminal organizations. The research supports previous literature that emphasizes the continuity between historical trade/migration corridors and contemporary CBC patterns. It also contributes new empirical evidence on the spatial intelligence of CBC groups, demonstrating how geospatial tools like GIS can be leveraged to better understand and counteract security threats in

maritime borderlands. Importantly, the study highlights several practical and theoretical implications. From a policy standpoint, it underscores the need for data-driven enforcement strategies, improved maritime surveillance and sustained trilateral cooperation between Malaysia, the Philippines and Indonesia. From a theoretical perspective, the research advances our understanding of maritime security by integrating insights from political geography, critical border studies and the political ecology of crime. It also illustrates the value of combining spatial technologies with grounded qualitative data for a more comprehensive analysis of regional security dynamics.

In revisiting the research objectives, the study has successfully mapped and categorized key CBC routes and staging points within the ESS Zone; demonstrated the role of geographical, historical and socio-political factors in shaping CBC movements; and provided recommendations for enhancing state capacity in surveillance, response and policy formulation. This paper is not only sheds light on the evolving nature of cross-border threats in Sabah but also offers a replicable model for studying maritime crime in other border regions. Addressing CBC in the Sulu-Celebes Sea will require more than tactical operations, it demands a long-term, holistic and regionally coordinated approach that integrates security, development and spatial intelligence. By synthesizing historical legacies with modern threats, this study contributes to a deeper understanding of border insecurity and informs more strategic interventions moving forward.

However, it is important to acknowledge several limitations in this study. The ongoing efforts of the Malaysian government, particularly through ESSCOM, have been effective in disrupting illegal CBC routes and staging points previously used by CBC groups. Many of the key routes and staging points discussed in this paper have been successfully dismantled, destroyed or controlled by Malaysian security forces, especially through operations led by ESSCOM in collaboration with their Philippine counterparts. As a result, the routes and staging points referenced in this study are not fully up-to-date, as they are constantly changing due to these continue operations. However, CBC groups and networks have adapted by shifting routes and employing new tactics to evade security forces. Consequently, challenges remain in completely eliminating CBC activities, particularly due to the persistent demand for smuggled goods into the Philippines and the ongoing need for labor in Sabah.

Additionally, while interviews with local residents, fishermen and other stakeholders provided valuable insights, the sensitive nature of the subject,

especially when it involves criminal organizations, may have caused some informants to be reluctant or unwilling to share their experiences openly. This potential underreporting is a common challenge in research conducted in conflict-prone or crime-affected areas. Therefore, the author acknowledges that this limitation is unavoidable in this study.

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