

Original article

Strategies to promote navigational safety and marine environmental protection: With reference to the Straits of Malacca and Singapore.

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Abstract

The Straits of Malacca and Singapore is without hesitation, a vital sea lane of communication with the geographical advantage of linking the Indian and Pacific Oceans. Geographically, the Straits of Malacca and Singapore is shallow and fairly narrow on its eastern part and has created one of the most important traffic choke points in the world. Being a crucial sea-lane has experience the Straits with high density of vessel traffic. The increase in shipping activities has risen the challenge in safety of navigation and marine environmental protection problem which generally end up with huge financial losses for the seafarers and damages to the marine environment. Owing significant limitations in the geographical landscape, this article has primary objectives to examine how navigational safety and marine environment can be effectively protect using existing regulatory instruments. This article provides a review and analysis of existing laws and regulations to assess the status of navigational safety for marine environmental protection in the Straits of Malacca and Singapore. The article also evaluates potential strategies to this problem using insights from literature. The article finds out that the littoral States to the Straits of Malacca and Singapore should adopt more forward-looking perspective in the formulation of legal measures to enhance navigational safety for marine environmental protection. The article finally suggests the potential strategies for navigational safety and marine environmental protection in the Straits of Malacca and Singapore. This will help in setting priorities for future efforts in improving navigational safety for marine environmental protection with regard to international and regional initiatives.

Keywords: Marine environmental protection, navigational safety, Straits of Malacca and Singapore

1. Introduction

Shipping is the conventional method of conveying bulk materials and items from one part of the world to another. There are approximately 116 straits used for international navigation around the world and some of them are renowned for their reputation as some of the world's most critical sea lines of communication and important international maritime chokepoints, which include Dover Strait, Hormuz Strait, Kara Strait, Strait of Malacca, Strait of Singapore and Strait of Gibraltar (Rusli, 2016). In connections to straits used for international navigation regime in the Law of the Sea Convention 1982 (LOSC), the Straits of Malacca and Singapore is considered as a single strait (Hamid, 2006; Martín, 2010; Rusli, 2012). The Straits of Malacca and Singapore is among busiest world shipping lanes which plays a major role in global trade. These Straits which connects the Indian Ocean to the South China Sea and the Pacific Ocean, are one of the busiest maritime crossroads in the world (Bird et al., 2006 p.532; Arsana and Sumaryo, 2010 pp. 11-16; Rusli, 2012; Pant 2019). Countries in Asia, as well Europe and the Middle East also gain advantage from using the Straits (MPA Singapore, 2008; Foon and Yi, 2016), which, about a quarter of the world's trade passes through these Straits every year (Verma, 2008; Hirst 2014). The Straits of Malacca and Singapore is the shortest sea route between Persian Gulf suppliers and the Asian markets especially China, Japan and South Korea. This Straits is the primary chokepoint in Asia, with an estimated US\$ 6.7 trillion of the world trade and 30% of the world's oil shipment traverse the Straits annually (UNCTAD, 2016). Figure 1 shows the map of the Straits of Malacca and Singapore.

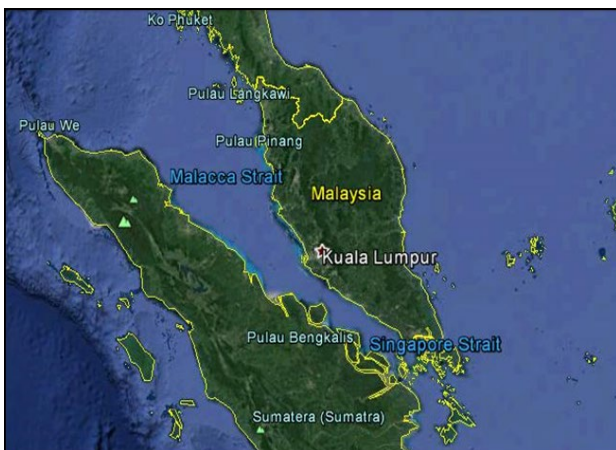


Figure 1: The Straits of Malacca and Singapore

Source: Google Earth (2018)

The entrance to the Strait of Malacca is located between

Ujung Baka at the northernmost tip of Sumatra to Lem Voalan in Phuket Island in Thailand (Rusli, 2012). The Strait lies between Sumatra and the Malay Peninsula with 500 nm in length and is geographically defined as a funnel-shaped passage. It varies in width from 126 nm at the north, narrowing down to the south with only 40 nm wide. The Strait of Singapore is approximately 60.8 nm in length and 8.639 nm in width. The Strait of Singapore was bordered by Malaysia and Singapore on the north and east and the Indonesian archipelago, the Riau Islands on the south and west. There are numerous tiny islands identified within the Strait including Keppel Harbour. The continuity of the Strait of Malacca and the Strait of Singapore has made the Straits to be asserted as the longest straits in the world with a total length of 600 nautical miles (nm) (Morse, 1818; Wu, 2016).

The direct control of the Straits of Malacca and Singapore is shared between Malaysia, Indonesia and Singapore (hereafter referred to as the 'littoral states'). The global trade activities in the Straits of Malacca and Singapore are essential for the growth of the economy in the littoral states as the Straits serves the entrance into the State's internal waters. After the implementation of the LOSC, Malaysia, Indonesia and Singapore have recognise the application of transit passage in the Straits of Malacca and Singapore with the fact that the straits has become indispensable to global shipping and trade. Singapore enjoys the biggest economic benefit from shipping activities that are taken place in the Straits of Malacca and Singapore. It has very limited non-renewable resources like oil and natural gas and thus the state needs to import for her consumption. Thus the Straits denotes as her lifeline that engulfs the entire state because it support the State for trade, food supply and other material needs (Chia, 1998 p.304). Rusli (2011) reviewed that the Straits also serves important economic salvations for the coastal communities that engage themselves in activities like fisheries and tourism aspects. The Straits of Malacca and Singapore is vast in marine resources which provide livelihood to various types of marine life. Some of them are sources of food and nutrition that essential in supporting many people especially coastal communities in the littoral states. The variety and diversity of fauna are found within the Straits, from squids to snails, from various fish to oyster as well as sea turtles, dugongs and many more (Mazlan et.al 2005). The coastal beaches and islands along the length of the Straits of Malacca and

Singapore have great natural beauty; possessing pristine white sandy beaches, coral reefs teeming with marine life and vast mangrove forest, mudflats and other natural attractions (Rusli, 2012).

It is a vital artery linking the region's economy with the rest of the world, therefore, the safety of navigation and marine environment protection in the Straits are of greatest concern (Sugihardjo, 2016). Thus, the purpose of this article is to examine the status of navigational safety for marine environmental protection in the Straits of Malacca and Singapore.

2. Maritime Traffic in the Straits of Malacca and Singapore

The Straits of Malacca and Singapore is vital shipping routes used for global trade and provides the artery through which a huge proportion of global trades are carried (Ho, 2009). Figure 2 shows the number of vessels movement in the Strait of Malacca and Singapore with an average increment of about 2000 vessels per year. In 2016, over 80, 000 ships sailed through the Straits of Malacca and Singapore, making it one of the world's busiest shipping route.

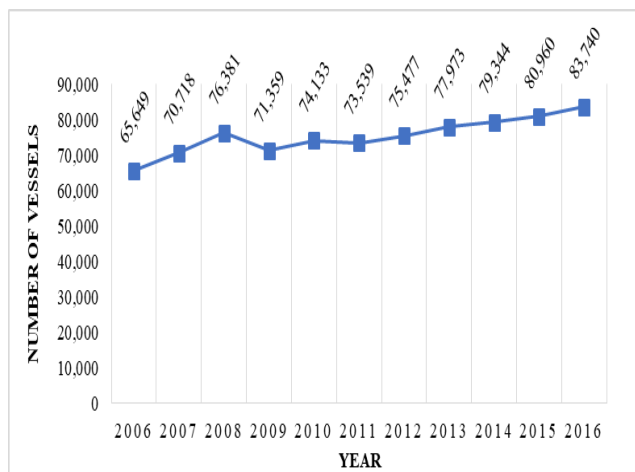


Figure 2: Number of vessels movement in the Strait of Malacca and Singapore

Source: Marine Department Malaysia (2017)

From 30, 000 transits in 1990 to more than 80, 000 shipping traffic in 2017, the Straits of Malacca and Singapore are two of the busiest waterways in the world, come second only to the Dover Strait in the English Channel. Notwithstanding the current situation, it is predicted that by 2020 the Straits of Malacca and Singapore will be navigated by approximately 150,000 vessels annually; nearly double the current transit rate

(Beckman, 2009; Rusli, 2012). In view of the expanding economies of East Asian nations, the Straits are expected to accommodate more shipping traffic in years to come. Table 1 shows the type of vessels transiting the Straits of Malacca and Singapore. In average, container ships and oil tankers form largest segment of the total amount of transiting ships in the Straits of Malacca and Singapore each year.

Table 1: Type of vessels transiting the Straits of Malacca and Singapore

Type	Year						
	2010	2011	2012	2013	2014	2015	2016
VLCC/ Deep Draft CR	4333	4539	4732	4825	4993	5324	5973
Oil Tanker Vessel	16247	16223	17345	18296	18765	18470	19466
LNG/ LPG Carrier	3579	3830	4014	4248	4173	3936	4057
Cargo Vessel	8445	7996	7950	7613	6989	7144	7225
Container Vessel	24806	25552	24639	24658	25071	25389	25768
Bulk Carrier	11642	10851	11678	12658	13454	15168	15547
Others	5081	4537	5119	5675	5899	5528	5686
Total	74133	73539	75477	77973	79344	80960	83740

Source: Marine Department of Malaysia (2017)

3. Navigational hazard and marine environment deterioration

Every ship enjoys the right to utilise the Straits of Malacca and Singapore pertaining to transit passage through straits used for international navigation, as provided in Part III of the LOSC (Terashima, 2008; Rusli, 2012). On a global scale, the Straits of Malacca and Singapore has acted as a natural bottle-neck for maritime trade between India and East Africa to the west, and China, Japan and the Malay Archipelago to the east. The presence of several factors that influenced the safety of navigation in the Straits of Malacca and Singapore poses challenge and threat to seafarers in their voyage through the Straits. The most difficult stretch for navigation in the Straits of Malacca and Singapore is in areas spanned by the Traffic Separation Scheme (TSS) at Horsburgh Lighthouse. The strait's waters is also shallow (less than 25 m). The narrowest breadth along the Straits of Malacca

and Singapore is off the southern tip at Phillips Channel, where it is about 1.96 nm. These narrowest point can be considered as the bottleneck of the shipping routes (Qu et al., 2011) and remains as contributing factor of marine casualties. High density of shipping activities at these narrow points may cause predicament among ships traversing the Straits where there is likely insufficient sea-room because more ships are concentrated here. The Straits of Malacca and Singapore also accommodates high shipping traffic, cross-strait traffic or coastal shipping. Maritime disasters may take place under conditions of narrow straits and the Straits had witnessed various accidents due to the collision. Maritime disasters at this territories may cause substantial loss to the assets, environment, human life as well as reducing the efficiency of supply chain from foreland towards overland and vice-versa.



Figure 3: Cross-strait traffic in the Straits of Malacca and Singapore

Source: Rusli (2012)

The presence of several factors like narrowness, traffic, weather and visibility has poses challenges and threats to seafarers in their voyage through the Straits (Rusli, 2012). In addition, the increasing number of ships passing through the Straits is a trigger for marine accident to occur. To date, there are over hundred cases of marine casualties and incidents reported in the Straits of Malacca and Singapore since 1970 and part of it are listed in Table 2.

Table 2: Marine accidents in the Straits of Malacca and Singapore

Year	Specifications of the incidents	Type of accident
1972	Japanese super tanker, Showa Maru, ran aground off Pulau Sebarok.	Grounding

1975	Liberian-registered tanker, Stolt Advance, ran aground about 4 km southeast of St John's Island	Grounding
1976	Collisions occurred in the Strait of Malacca. The first between Diego Silang and Vysotsk and the second, a few minutes later, between Diego Silang and Brazilian Faith.	Collision
1987	Thai-registered crude-oil tanker Orapin Global collided with Cyprus-registered tanker Evoikos, about 5 km south of the Singapore Port Limit	Collision
1992	A container ship Ocean Blessing collided with the hijacked tanker Nagasaki Spirit occurred in the northern part of the Malacca Straits. As a result of the collision, about 12,000 tonnes of Nagasaki Spirit's cargo were released into the sea and caught fire.	Collision
1997	Panama-registered vessel, Natuna Sea, ran aground off Batu Berhanti Beacon, just 8 km from Sentosa	Grounding
2000	Malaysian-registered tanker, MT Bunga Kelana 3 and St Vincents, collided with Grenadines-registered bulk carrier, MV Waily, about 13 km from Changi's shore.	Collision
2010	Liberia-flagged containership, Hammonia Thracium and the Panama-flagged chemical tanker, Zoey, collided off Sebarok Island.	Collision
2014	Hong Kong-flagged chemical tanker, Lime Galaxy and China-flagged container ship, Feihe, collided around 2.7 km south of Jurong Island.	Collision
2014	Panama-flagged container ship, NYK Thermis and Singapore registered barge, AZ Fuzhou, collided about 4 km south of Marina South.	Collision
2015	Libyan-registered oil tanker, Alyarmouk collided with a Singapore-registered bulk carrier, Sinar Kapuas about 11 nm north-east of Pedra Branca.	Collision

2015	Cayman Islands-registered chemical tanker, Stolt Commitment and Thorco Cloud, the Antigua and Barbuda-flagged freighter, collided about 11 km north-west of Batam.	Collision
2016	The Panama-flagged Very Large Crude Carrier (VLCC), Dream II and containership, MSC Alexandra collided about 3 km South-East of Sebarok Island	Collision
2017	The guided-missile destroyer USS John S. McCain collided with the merchant vessel, Alnic MC at the east of Straits of Malacca and Singapore.	Collision

Source: IMO (2018)

With the presence of more than 60 small islands and islets dotting across the Straits, mariners find it difficult to navigate through. The waters of the Straits are shallow; the water level changes with the changing of the tides. Despite dredging works, the waters of the Straits have become shallower because of continuous siltation. There are approximately 11 identified wrecks along the Straits of Malacca and Singapore and these wrecks may cause a bottleneck effect to traffic (Rusli, 2012). All those features may cause marine accident and therefore will affect the welfare of the marine environment in the Straits of Malacca and Singapore. The effects marine pollution in the Straits has become alarming and poses a serious threat to the beauty of the coast. Out of all the pollutants entering the sea, oil seems to attract the greatest attention and perhaps, casualties that involve oil tanker incidents are often perceived as the most important sources of marine pollution (Arman Habib, 2014). To date, there are over hundred cases of oil spills from ships in the Malacca Strait since 1970 (Marine Department Malaysia, 2017). More than half of the incidents cause damage to the marine environment. In addition, the Straits of Malacca and Singapore also experience oil pollution from ship operation corresponding to bilge pumping, as well as from tank cleaning, which leads to dumping of oil and sludge by ocean going vessels. Oil and its refined products that spilled may affect organisms through physical and toxicological processes, as well as habitat impacts, food chain disruption and alteration to their community (Pourvakhshouri et al., 1998). The existing pollution issues in the Straits of Malacca and Singapore

demand serious attention and thus, the protection and the preservation of the marine environment in the Straits of Malacca and Singapore is crucial. Due to significant limitations in the geographical landscape coupled with marine pollution issues, the purpose of this article is to examine the status of navigational safety for marine environmental protection in the Straits of Malacca and Singapore.

4. Methodology

The approach of this study mainly involved an analysis of international legal framework pertaining to the navigational safety and protection of the marine environment of Straits of Malacca and Singapore. This article also assess the status of navigational safety for marine environmental protection in the Straits of Malacca and Singapore using insights from literature. Further, this article evaluates potential strategies to this problem.

5. Current status of navigational safety and marine environmental protection in the Straits of Malacca and Singapore

The increase of shipping traffic through the Straits of Malacca and Singapore each year has eventually create complex situations for the littoral states. The Straits of Malacca and Singapore is national asset to the littoral states, thus the states have to take initiatives to ensure the safety in navigation in order to protect and preserve the marine environment of the Straits (Dahalan et al., 2013). Several managerial and navigational solutions have been implemented in the Straits of Malacca and Singapore over the past 30 years to enhance safety in navigation (Sulaiman et al., 2013 p.338) like the Automatic Identification System (AIS) and the Traffic Separation Scheme (TSS).

The international legal framework to govern protection of the marine environment has been implemented in the Straits of Malacca and Singapore. Indonesia, Malaysia and Singapore, as littoral States to the Straits of Malacca and Singapore have ratified and domesticated the LOSC and the important IMO conventions into their national legislation. Thus, with the enforcement of the legislation in their water areas under national jurisdiction, the States have the obligation to protect and preserve the marine

environment. LOSC provides the basic legal framework for protecting the oceans while the convention on the control of pollution from vessels fall directly under IMO. The IMO splits the conventions into three main categories; maritime safety, prevention of marine pollution, and liability and compensation. Based on IMO (2016), International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (MARPOL 73/78) is the most important convention covering prevention of marine pollution from ship. The littoral States to the Straits of Malacca and Singapore have ratified the related IMO conventions on safety of navigation and marine environment protection. The list of IMO conventions that have been ratified by the littoral States are summarised in Table 3.

Table 3: Ratification of IMO Conventions by Malaysia, Singapore and Indonesia

Name of Convention	Malaysia	Singapore	Indonesia
United Nations Convention on the Law of the Sea 1982 (LOSC)	Ratified	Ratified	Ratified
International Maritime Organisation (IMO) Convention 1948	Ratified	Ratified	Ratified
International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969, Protocol 1992	Ratified	Ratified	Ratified
International Convention on Tonnage Measurement of Ships (TONNAGE), 1969	Ratified	Ratified	Ratified
Convention on the International Regulations for Preventing Collisions at Sea, 1972 (COLREGs)	Ratified	Ratified	Ratified
International Convention for	Ratified	Ratified	Ratified

the Safety of Life at Sea 1974 (SOLAS)			
International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 (STCW)	Ratified	Ratified	Ratified
International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC), 1990	Ratified	Ratified	-
Protocol to the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), 1992	Ratified	Ratified	-
MARPOL 73/78 Annex III	Ratified	Ratified	Ratified
MARPOL 73/78 Annex IV	Ratified	Ratified	Ratified
MARPOL 73/78 Annex V	Ratified	Ratified	Ratified
MARPOL 73/78 Annex VI	Ratified	Ratified	Ratified
Protocol on Preparedness, Response and Cooperation to pollution, Incidents by Hazardous and Noxious Substances (OPRC-HNS Protocol), 2000	Ratified	Ratified	-
International Convention on Civil Liability for Bunker Oil Pollution Damage, 2001	Ratified	Ratified	Ratified

(Bunker Convention)			
International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), 2001	Ratified	Ratified	Ratified
The International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWMC)	Ratified	-	-

Source: IMO (2016)

With the adoption and ratification of the conventions by the governments of the littoral States, it illustrates that the States has shown their commitment to protect the marine environment of the Straits. In addition, the law and regulations are applicable to the environmental management in the Straits of Malacca and Singapore are up to international standards as the littoral states have adopted required regulation in line with international law. This is supported with the reduction in number of marine accident in Table 4.

Table 4: Number of marine accident in the Straits of Malacca and Singapore

Year	Number of Accidents
2010	74
2011	88
2012	60
2013	45
2014	35
2015	29

Source: Marine Department Malaysia (2017)

The statistic portrayed the effectiveness and sufficiency of present instruments introduced by the littoral states to mitigate any occurrence of marine pollution by vessel in the Straits of Malacca and Singapore. It is very important to enhance the marine environmental protection in the Straits of Malacca and Singapore so that the straits can be asserted as a safe and pollution-free waterway for international navigation in the future.

6. Strategies to enhance safety of navigation and marine environmental protection in the Straits

Shipping is and always will be full of risks thus the increased in vessel traffic has risen the challenge of marine pollution problem which generally end up with huge damage to the marine environment. All of the strategies are evaluated based on the literature to govern the issues of navigational safety and marine environmental protection in the Straits of Malacca and Singapore.

Managing and reducing incident and pollution risks in the Straits requires hard work among user and littoral states toward compliance with international conventions on navigational safety. The three littoral states, Indonesia, Malaysia and Singapore have been cooperating to enhance navigational safety as well as environmental protection in the Straits of Malacca and Singapore. After the commencement of the Joint Statement 1977, the littoral states to the Straits of Malacca and Singapore closely work together to confirm that both Straits are safe to be navigated even with the increase of traffic volume. Accordingly, the States has formed the Tripartite Technical Experts Group (TTEG) in 1975 to counterpart efforts to promote safety of navigation and environmental protection in the Straits (Djalal, 2008). The TTEG is fundamental for the safety of navigation and marine environmental protection in the Straits of Malacca and Singapore. With recognition that maintaining the safety of navigation the Straits is the responsibility of the three States bordering the Straits, thus the governments of the States has proposed the set of guidelines which subsequently became the terms of reference for the TTEG which includes (Marine Department Malaysia, 2016b):

1. Working to enhance safety of navigation;
2. Promote close cooperation and coordination on anti-pollution policy and measures in the Straits; and
3. Initiate consultation with IMCO, (the then IMO) on the Traffic Separation Scheme, and with users of the Straits

TTEG which comprises of officers from the Maritime and Port Authorities and Hydrographic Offices play the supervisory role and has made significant extend in the enhancement in safety of navigation in the Straits. Many people in the shipping community have and continue to recognise that the TTEG plays an essential part in

maintaining maritime safety for the Straits (Oei, 2001). The maintenance issues on safety of navigation in the Straits remains one of the key challenges for Malaysia, Indonesia and Singapore as the Straits is the international shipping lane with high volume of traffic. More traffic means more probabilities for the marine incident to occur. The issues are being continuously discussed by the TTEG, which then lead to the establishment and development of the Vessel Traffic System, the Voluntary Pilotage Service, Emergency Towing Vessel and also the Marine Electronic Highway (MEH) in the Straits of Malacca and Singapore.

In consequences with substantial financial burdens that has been faced by the littoral states face permitted to meet international expectations to pledge safe in shipping within the Straits, has raised up the idea of burden sharing (Khalid 2006). Therefore, the principle of burden sharing has become the basis for Cooperative Mechanism and this has dismissed the littoral states from their financial burden. The Cooperative mechanism addresses the implementation of Article 43 of LOSC which stated that littoral and user States should by agreement cooperate in the enhancement of the safety of navigation and marine environmental protection. This statement is in line with the systematic management and organisation as response to extensive marine pollution and navigational hazards. The Cooperative Mechanism has made much headway in the eleven years since its inception in 2007 as it acts as an important avenue for maintaining navigational safety and environmental protection of Straits based on commonly agreed principles and mutual respect between littoral states, the user states and the industry. It was the first cooperative framework in the world that provided a platform for littoral states, user states and other stakeholders in a strait used for international navigation, to jointly work on maintaining and enhancing the safety of navigation and marine environmental protection. When it was launched, the Cooperative Mechanism set a historic milestone for the international maritime community. Both reflect the conjunction of interest between the littoral states, user of the Straits as well as the international maritime community in enhancing the navigational safety and environmental protection of the straits. To date, the Cooperative Mechanism have continued to grow steadily, and has made good pace in keeping the Straits of Malacca and Singapore safe and clean for domestic and international shipping events.

Under Cooperative Mechanism, Aids to Navigation Fund was established in order to ensure that there is long-term and sustainable means of financing the maintenance of critical aids to navigation in the Straits. The purpose of the Aids to Navigation Fund is to receive direct financial contributions from user states and other parties for the provision and maintenance of aids to navigation in the Straits of Malacca and Singapore. The aids to the Navigation Fund shall be on voluntary basis and the Fund is flexible and open to various forms of contributions to accommodate the contributing party's varied considerations and financial circumstances. Contributions may be received from States, industry, private benefactors, non-governmental organizations and inter-governmental organizations, including the IMO. The fund will provide the means for all users of the Straits to contribute financially towards the maintenance of the aids to navigation in the Straits, such as light beacons and light buoys.

One of the biggest problems with marine pollution is its transboundary nature. In order to address this issue, strengthening of the regime is required to minimize peril of marine pollution. The improvement on current framework in the context of legal, cooperation and management will make a major impact on shipping safety and benefit the well-being of the oceans. Thus efficient compliance and enforcement of the adopted international conventions are necessary to protect the marine environment of the Straits of Malacca and Singapore.

8. Conclusion

From the above discussion, it can be concluded that the Straits of Malacca and Singapore is not spared from being exposed to an issue pertaining to navigational risk and marine pollution. The strategies to further enhance navigational safety and marine environmental protection in the Straits of Malacca and Singapore can be summarised as follows:

1. Ensuring that the Straits is safe for shipping activities and environmentally protected, the littoral states, user states and the international community should prolong the existence cooperation.
2. The littoral States need to invite broader involvement from the user states, shipping industry and stakeholders to ensure the sustainable contribution in aids to navigation fund; and

3. Legal framework and government policy against marine pollution prevention need to be strengthened by improving the level of compliance and enforcement.

The findings in this article is important to promote sustainable development so that the Straits can be asserted as a safe and pollution-free waterway for international navigation in the future.

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