

The Outside of Port Limit (OPL) as a new maritime zone to overcome marine pollution due to oil sludge impacting the coast of Bintan, Indonesia to actualise sustainable development

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Abstract. The Coastal pollution in Bintan, Indonesia, caused by illegal oil sludge discharge from vessels breaches the provisions of the International Convention for the Prevention of Pollution from Ships (MARPOL) regarding the sludge oil discharge 30 ppm from tank cleaning and 15 ppm from machinery spaces, which is has been problem since the 1970s until today, The culprit has not been found until now because the problem of proof scientific verification between the pollutant and the impact of the pollution. Based on research using a research paradigm, qualitative methodology, and empirical legal research, The results of this study indicate the eastern segment 2 of the Singapore Strait, which is a grey area, is a source of oil sludge pollution. Therefore, it is recommended to make a strategy to overcome this pollution with establish and regulate a new maritime zone, namely, outside of port Limit (OPL) in the United Nations Convention on the Law of the Sea (UNCLOS), thus littoral state can establish OPL in their territorial sea to monitor and prevent illegal sludgde oil discharges into the sea and especially the problem of oil sludge pollution in Bintan can be overcome. Therefore, sustainable development goals can be realized.

1 Introduction

Human rights include the right to a safe and healthy environment, as stated at Stockholm 1972 [1]. Human life sustainability determined on the quality of a decent and healthy environment. To avoid pollution, mankind must protect and safeguard their environment. Anthropocentric human thought harms or pollutes the environment [2]. Anthropocentrism has ignored justice for the environment. Sea pollution is a type of environmental pollution. The marine environment has the potential to get polluted. Pollution of the marine

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environment has a negative impact on various sectors. One of these is marine pollution caused by pollution sources from the oil sludge discharge from vessels.

The northern shore of Indonesia's Bintan Island is exposed to marine pollution caused by activities at sea, which impacts both marine and shore pollution. This pollution, caused by oil sludge, has persisted since 1970 and remains unresolved. Despite attempts to address the issue over the years, it reappears annually during the north wind season from September to April.[3] The source of oil sludge comes from vessel tank cleaning activities in areas considered Outside of Port Limit, hereinafter referred to as OPL [4]. This location is situated near the Singapore Strait's eastern reaches, particularly in the waters surrounding 3 Littoral State Indonesia, Malaysia, and Singapore. This location is Segment 2 East of the Singapore Strait which is a gray area. [4, 5, 6]. These waters are often mistaken for OPL, as there are several OPL around these waters [7]. The area is popularly known by the acronym OPL [8]. The sources of pollution detected in the area are as follows. [9]

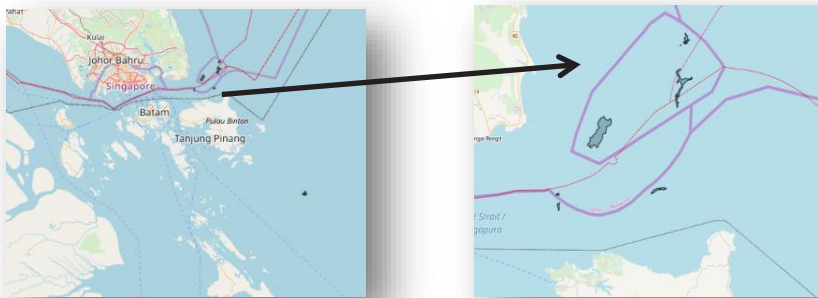


Fig. 1. Oil sludge pollution source detection retrieved from Lapan satellite imagery in Batam-Bintan waters [9].

Based on satellite imagery, it is suspected that vessels are discharged their waste around these waters, which are considered by the user state as international waters because it is a grey area. The vessel also anchored illegally in waters considered OPL and discharged oil sludge into the sea during anchorage. However, it was difficult to catch the culprit because the ship that discharged the waste during its journey in the waters turned off the Automatic Identification System (AIS) on the ship [10, 11]. The Bintan government's efforts aim to clean the beach and reduce oil sludge in coastal waters, yet they do not fully prevent oil sludge disposal originating from oil discharge and ship tank cleaning conducted in areas considered OPL that are carried by the current and cause oil sludge to enter the coast of Bintan during the north monsoon season. Despite these efforts, they have limited impact on marine pollution events. Oil discharge leads to pollution every year. The issue of scientific verification required to demonstrate the causal relationship is one of legal barriers in pollution of marine environmental pollution litigation. The polluters have yet to be identified, as have the polluters' perpetrators [12]. The pollution that occurred in this case, it is difficult to find the culprit because the source of the pollution is in the gray area.

The problems faced are an obstacle to managing marine resources sustainably. This condition is exacerbated during the north wind season. The impact on the tourism sector is that tourism entrepreneurs experience material losses. The impact on the tourism sector, tourism entrepreneurs experience material losses. As experienced by the manager of Mutiara Beach Resort Bintan. The pollution also affects marine life. Turtles and others are affected. This condition is also felt by the local community, which causes pungent odour. For fishermen, it has an impact on the destruction of fishing gear and floating “kelong” [14]. Environmental

pollution, particularly in the marine environment, poses a significant threat to human survival, potentially causing severe negative impacts on various life sectors [15]. The international community is obliged to contribute to transboundary marine environmental concerns by establishing conventions and treaties at the global, regional, and national levels to safeguard the marine environment [16]. Pollution of the marine environment is expressly addressed in Chapter XII of the 1982 United Nations Convention on the Law of the Sea, abbreviated as UNCLOS. [17]. According to UNCLOS Article 194 (1) and (2), each state has the obligation and responsibility to avoid, mitigate, and regulate maritime pollution. As allowed for in UNCLOS Article 197, each State may safeguard the maritime environment individually, regionally, internationally, or with the support of international institutions. Thus, ocean pollution has a consequence, which is the notion that governments must collaborate at the global and regional levels to alleviate marine contamination.

To address the issues that arise, it is necessary to make efforts to reduce pollution caused by oil sludge discharge from ship activities in the waters of East Segment 2, which is designated as an OPL area in the waters of the three littoral states of Indonesia, Malaysia, and Singapore, by establishing a new maritime zone in the same manner as other maritime zones established under UNCLOS. To combat this pollution and achieve sustainable development goals under Point 14 of the 2030 Agenda for Sustainable Development, namely, protecting and managing the oceans, seas, and marine resources sustainably, a new maritime zone must be established. This is one of the SDGs (Sustainable Development Goals).

2 Method

2.1 Research Paradigm

Research methods are based on a certain paradigm. The paradigm is the frame of reference for this research [18]. To integrate the research method into the research conducted, it is necessary to be based on the research paradigm [19]. The research paradigm is based on ontology, epistemology, and methodology [20]. The research paradigm in this dissertation research is as follows. Ontology directs researchers to conduct research on existing reality. Ontology determines the reality to be researched and what can be known about it. As the reality in this research regarding the occurrence of marine pollution in the outside of port limit area due to sludge oil that affects the coast of Bintan Indonesia. Epistemology is the study of the nature of knowledge and the process by which knowledge is gained and assessed [21]. The epistemological question is: what are the basic statements about knowledge [22]. In this research, knowledge is processed with inductive patterns to find the validity of the correspondence towards the reality. Methodology determines how researchers gain knowledge about reality in practice. Methodology is a well-articulated and theoretically grounded method for collecting data. The research design is influenced by Methodology [21]. Methodology is an important procedure that leads to critical subjectivity and strengthens the validity of the researcher's assertions when presenting subjective-objective statements. This study used a method of qualitative research.

Therefore, the research design in this study is interpretative. The purpose of the interpretative approach is to completely understand the phenomena that occur. Informants' qualitative data is collected. The technique for examining the generated data is inductive, which means that the researcher looks for patterns in the data that can be broken down into broad themes in order to explain a phenomenon and develop a hypothesis [23]. The reality in this research is based on empirical experience [24], namely, marine pollution in the Outside of Port Limit area due to oil sludge, which affects the coast of Bintan, Indonesia. An inductive

technique is used in interpretive research [24]. This research adopts epistemological elements in the form of intersubjective or interactional reality with the qualitative methodology used.

2.3 Empirical Methods

Methods are specific ways to collect and analyze data [21]. To collect the data in this research, a special method is used to collect and analyze the data using empirical methods [25]. The goal of this study is to figure out how to deal with marine pollution caused by oil sludge off the coast of Bintan, Indonesia. According to the study provisions of the rules and regulations that apply to the research problem with facts in the field or observe the reality that occurs, namely, marine pollution caused by oil sludge or oil sludge that affects the coast of Bintan, Indonesia. This method will allow researchers to gather data from diverse elements of the subject under investigation. [26]. The research conducted is prescriptive in nature because, from the results of this study a description or formulation of existing problems is obtained and solutions and suggestions regarding what should be done to overcome the problems studied [25].

2.4 Data Collection

The data for this study was gathered through field investigation and reading. Primary data and secondary data are the two forms of data collected. Secondary data is made up of three types of legal resources: primary, secondary, and tertiary legal information [27]. The data collection tools used consisted of interview guidelines, tape recorders, and cameras. Data collection techniques are divided into primary and secondary data collection techniques. Primary data is used by researchers when they want to conduct empirical research using observations and interviews as data collection tools. Secondary data collection techniques in this research include literature studies, subscription, free, and print resources, and Focus Group Discussion (FGD).

2.5 Data processing and analysis techniques

In addition, the results of field and literature research will be examined qualitatively. Bintan Island is the research site. Bintan Island is situated in the Indonesian waters. The Indonesian seas are also part of Singapore Strait's littoral state, and there are user states of strait overthere. The data processing in this study is outlined in various parts [28], namely, the data gathering procedure, Verbatim [29], checking or validating field data, editing, and coding. Content analysis is carried out with the survey, read, recite, and review steps.

3 Result and Discussion

Marine pollution, particularly in Indonesia, can disturb the functioning of marine ecosystems. One of them is maritime pollution caused by shipping activity, which has impacted Bintan, Indonesia, owing to the release of oil sludge. It is one type of oily waste created by vessels. Marine pollution from shipping activities often occurs for reasons of economic efficiency. One activity of ships is the discharge of oil, commonly known as oil spillage. To do this, ships clean their tanks (the cargo holds of tankers) and/or machinery spaces (the engine room of the ship), producing an oil residue called sludge oil. Ships dispose of their sludge by discharging it during the voyage and by disposing of it at sea. [30, 31] As the law of the sea

has progressed, efforts have been made to protect the marine environment from oil discharge activities by means of international arrangements and organizations. When marine pollution arises from oil sludge, it implies that the discharge of oil sludge from the ship has exceeded the discharge threshold established by MARPOL. Subsequently, the activity can be deemed an illegal oil sludge discharge.

Annex I, MARPOL 73/78 deals with pollution from the discharge of oil sludge from vessels [32]. Annex I, MARPOL 73/78 deals with regulations for the prevention of pollution by oil. One of the pollution is oil discharge in the form of sludge oil. Regulations regarding oil discharge from machinery spaces in the form of sludge oil are regulated by Regulation 15 concerning control of sludge oil discharge, Chapter 3 concerning requirements for machinery spaces of all ships, Annex I, as well as provisions regarding oil discharge in special areas (special areas) and outside special areas (outside special areas). Based on these provisions, sludge oil discharge carried out outside the special area is allowed if it fulfils the conditions as described below. Firstly, the ship can perform an oil discharge if its position is en route. Second, the oil mixture being processed must be equipped with oil filtering equipment as specified in Regulation 14. Vessels must be equipped with oil filtering equipment as described above to conduct oil discharge in the form of sludge from machinery spaces. Third, the content of sludge oil discharged must not exceed 15 ppm. Fourth, oil discharge is not mixed oil originating from tanker tanks. And other technical rules also regulate the requirements for machinery spaces on all ships. The same provisions are also applied in special areas with the addition of provisions, videlicet the oily mixture, in the case of oil tankers, is not mixed with oil cargo residues.

MARPOL also regulates oil discharge from tanker cargo tanks, as specified in Annex I of the Regulations for the Prevention of Pollution by Oil, Chapter 4 (Annex I of the Regulations for the Prevention of Oil Pollution, Concerning Requirements for the Cargo Area of Oil Tankers, Regulation 34) of MARPOL [32]. Oil discharge to the cargo area of oil tankers outside the special area is permitted if the following conditions are met: the tanker is not inside the special area, the tanker is more than 50 nautical miles from the nearest land, the tanker is underway, the instantaneous oil content release rate does not exceed 30 ppm, the tanker has an oil discharge monitoring and control system, and a slop tank arrangement as required by regulations 29 and 31. The discharge of oil sludge from the tanker's cargo section is forbidden in specified locations. Indeed, as demonstrated below, marine pollution is now impacting the coast of Bintan, Indonesia.

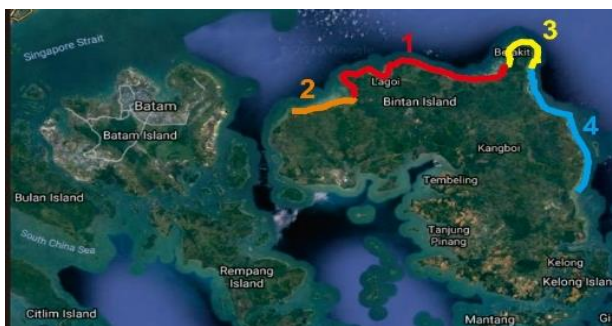


Fig. 2. Oil sludge affected areas in coastal Bintan, Indonesia based on the data sources from Bintan Environment Agency, Indonesia [10].

The figure shows the area affected by oil sludge on Bintan Coastal. The affected area is divided into four zones on the Bintan Coast, namely, Zone 1 at Lagoi Beach, Zone 2 at

Syaker Beach, Zone 3 at Berakit Beach and Zone 4 at Trikora Beach. The pollution has had a detrimental effect on the coast of Bintan, Indonesia, as shown in the image below.



Fig. 3. Marine pollution caused by oil sludge on the Bintan Coastal, Indonesia, in 2023, was photographed directly from the location affected by oil sludge at Berakit Beach, Bintan, Indonesia, on January 17, 2023.



Fig. 4. Marine pollution due to oil sludge Impacting Bintan Coastal, Indonesia, in 2023 was photographed directly from the location affected by oil sludge at Penyusuk Island, Bintan, Indonesia on May 5, 2023.



Fig. 5. The shore of Bintan, Indonesia, is polluted by oil waste, as documented by Environmental Agency of Kepulauan Riau, Indonesia.



Fig. 6. Oil Sludge Polluted Mangrove Trees [33].



Fig. 7. Female Hawksbill Turtle Found Covered in Oil Sludge in Bintan, Indonesia [34].

The source of pollution comes from the area considered as OPL as shown in the following satellite data.

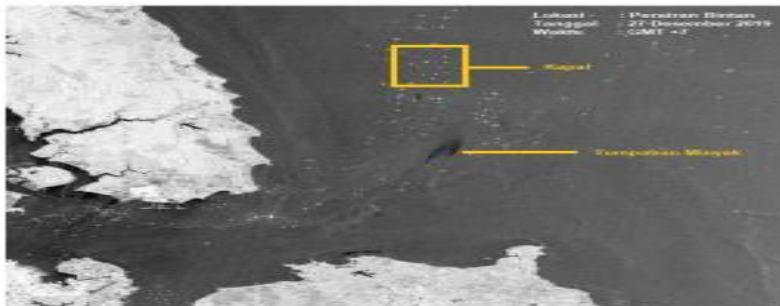


Fig. 8. Data Processing Result of Sentinel-1 Satellite Image Data [35].

As illustrated above, the findings of data processing utilising the Sentinel Application Platform software, also known as SNAP, reveal multiple places with a darker look (black spots). Dark blotches in the data represent oil spilled locations, whereas white dots along the area represent ship objects. The oil leak in the Lagoi area is thought to have begun in

International Waters; this area is a grey area (30-50 metres distant) that extends to the Lagoi area and its environs. The LAPAN data displays the same information as seen below.

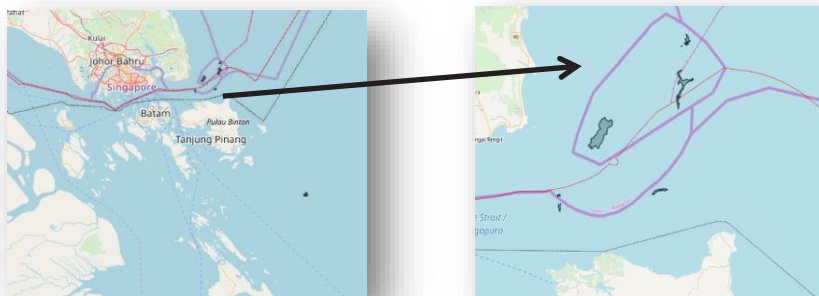


Fig. 9. Sludge oil detection di area [9].

The data also shows that, based on the results of research and interviews at KPLP (Indonesia Coast Guard), the alleged pollution is in the same location as follows.

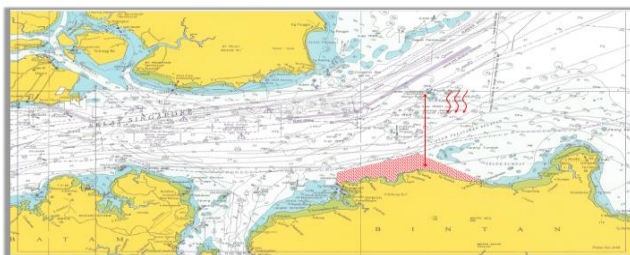


Fig. 10. Area of Suspected Source of Oil Sludge Pollution in accordance with empirical data from KPLP.

The area is actually Eastern Segment 2 of the Singapore Strait as shown below.

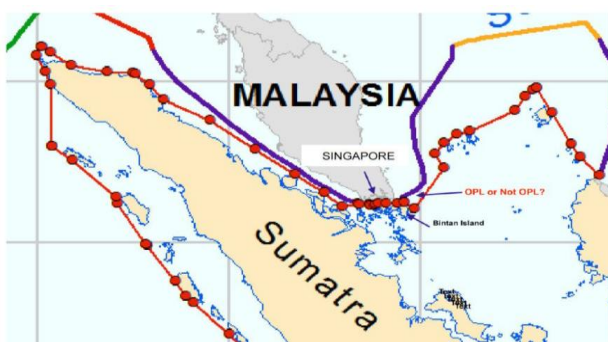


Fig. 11. East segment area 2 [5].

In the illustration, there are labels and arrows indicating that between the three littoral states there is a grey area and it cannot be determined whether the area is OPL or not, causing misinterpretation. However, currently the area is popularly referred to using the acronym OPL. The use of the term Outside of Port Limit (OPL) in the eastern segment 2 (hereinafter

referred to as OPL Eastern Segment 2) is not the same as the OPL or anchorage area where there are anchorage facilities and ship operational activities as described in the previous section. Whereas in OPL Eastern Segment 2, there are no anchorage facilities and ship operational activities. So far, the OPL has been considered international waters and not under the jurisdiction of any country. This is because there are still sea segments in the eastern part of the littoral states, videlicet Indonesia, Malaysia, and Singapore, which still have not established sea boundaries in these waters. So that it creates uncertainty about clear boundaries for ships passing through the waters of Bintan Indonesia, Malaysia, and Singapore. Thus, the maritime boundary between Indonesia, Malaysia, and Singapore in The East 2 segment is still a grey area. If there is a breach in eastern segment 2 that is considered OPL, costs and responsiveness can be affected by the uncertainty of which country has jurisdiction in the case [38, 39].

Current and wind movement factors during the Northeast Monsoon also influence the introduction of pollution to the coast of Bintan, Indonesia. As shown below.

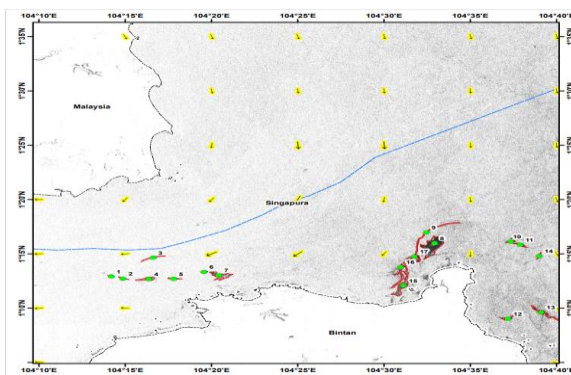


Fig. 12. The movement of oil sludge into the waters of Bintan Indonesia is based on data sources from the Marine Observation Research Agency Satellite, Indonesia.

Satellite data shows point detection of oil slicks and satellite imagery shows the movement of oil slicks into the waters and coastline of Bintan, Indonesia. The entire coastline is affected by the oil coming out of the sea. The direction of movement of the spill in the sea is influenced by the movement of surface currents, which are influenced by the wind and tides that occur at that time, because ocean currents are oceanographic factors that spread oil when it is spilled into the water after forming a layer (slick), so that it immediately increases the surface area of the oil. Oil spilled into the sea can take the form of surface spreading, evaporation, emulsification, dissolution, biodegradation, dispersion, sedimentation, advection and turbulent diffusion. A lot of factors impact the spread of an oil spill, including the winds and currents near the spill site, the qualities of the oil, and the tides. Spilled oil can form a film or an emulsion. Oil that has been scattered (moved from its original site) can have the same consequences as oil that has been spilt in its original place. The flow of oil slicks along the coast of Bintan is controlled by the wind conditions in Bintan waters throughout the northern season. From November to March, the wind typically blows from the north during the northern monsoon season. The wind blows mostly from northeast to southwest throughout this season, with an average speed of 3.6-5.7 metres per second. Because it is the quickest compared to other seasons, the speed in this season is one of the most influential in the movement of currents that cause the transfer of oil spills into the water. [35]. This is why pollution in the northern of Bintan Island will be brought ashore and pollute the Bintan Coastal, Indonesia. The pollution is also influenced by the currents in Bintan waters as shown in the following windrose.

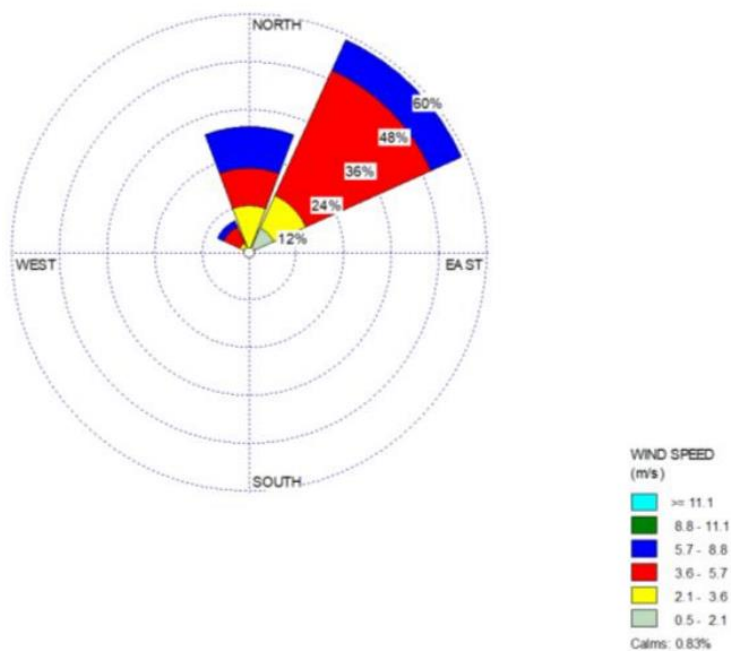


Fig. 13. Windrose wind speed [35].

Based on the Windrose wind speed, the current speed in Bintan waters is known to be 4.28 metres per second in the North season. Monitoring from the Marine Research and Observation Centre, Marine Research Centre of the Ministry of Maritime Affairs and Fisheries together with the Ministry of Communication and Tourism (2015-2020), and also monitoring from the Regional Team for Oil Spill Response of Riau Islands Province (2018-2022). The seas of Bintan and its surrounds are frequently polluted by oil from an unknown source. The pollution's path is thought to be transported by north monsoon currents and winds [38].

In the case of pollution that occurred in the area of eastern segment 2 of the Singapore Strait, which is considered OPL, which is a grey area, there has been a violation of oil sludge discharge that exceeds the regulatory threshold for oil discharge as regulated in MARPOL regarding provisions on oil sludge discharge. The International Convention for the Prevention of Pollution from Ships under MARPOL defines legal discharge limits for ships, limiting discharges to no more than 15 ppm (parts per million) in water. When oil is visible on the sea surface, it means that the oil sludge discharge from machinery spaces has been greater than 15 ppm or the oil sludge discharge from cargo tanks or tank cleaning has been greater than 30 ppm. In addition, it is also regulated that the discharge of waste oil from oil cargo can be carried out if the tanker is located more than 50 nm from the nearest island as stipulated in Regulation 34 of MARPOL and there is a prohibition on oil discharge in special areas. Any visible traces of oil at sea or in the waters near the ship, indicate a violation and must be investigated. Therefore, an offence has been committed and investigative action should be taken immediately [31].

Furthermore, according to present conditions, the Bintan Coast is part of Indonesia's maritime seas, as well as the Littoral State of the Singapore Strait. In the Singapore Strait,

there is also a user state. The area serves as an international maritime route, with the Malacca Strait and the Singapore Strait providing access to international trade from the west to East Asia and vice versa. As a result, this place is fairly congested. The Strait of Malacca and Singapore (SOMS) is now one of the busiest maritime channels in the world. The strait transports one-third of the world's commercial products. According to projections, marine traffic in the region will rise significantly [39]. Measures routing SOMS as far as Sedepa Settlement (One Fathom Bank) to around Horsburgh Lighthouse, a total distance of 250 nm [40]. The littoral waters of Indonesia, Malaysia, and Singapore are one of the world's major SLOC (sea lines of communication) and SLOT (sea lines of trade), which is very important for Indonesia, Malaysia, and Singapore as littoral states and ships as user states [41]. For user states from countries in East Asia, the waters are a distribution route for energy imported from the Middle East and neighbouring countries [42].

The East Segment 2 area is considered an OPL because there are several OPLs around the area. The OPL area is actually the anchorage of ships outside the port, which is a common practice for ships in various countries carried out for various reasons, such as conducting activities while waiting for orders or while waiting for berths at the port, while waiting for payment, bunkering, tank cleaning, and others. One of the reasons countries form and practice OPL is because when ships perform tank cleaning or sludge oil discharge, this has the potential to cause marine pollution due to the waste. Oil sludge is a hazardous waste [43, 44]. Pollution from hazardous waste in the form of oil sludge from ship activities has the potential to pollute the sea. OPL has been practiced in various littoral states to prevent such pollution by providing one of them with sludge oil discharge facilities and can be supervised by these activities [44], including being practiced by various littoral states with names that are not yet uniform but have the same practice [45], Among them are as follows.

Table 1. Pengaturan OPL di berbagai littoral state based on data processing by the author

NO	Country	OPL and other mentions
1	Indonesia	Labuh Jangkar Berakit, Indonesia
		Labuh Jangkar Tanjung Uban, Indonesia
		Labuh Jangkar Batu Ampar, Indonesia
		Labuh Jangkar Kabil, Indonesia
		Labuh Jangkar Galang, Indonesia
		Labuh Jangkar Nipah, Indonesia
		Labuh Jangkar Karimun Besar, Indonesia
2	Singapore	West Outer of Port Limit of Singapore
		East Outer of Port Limit of Singapore
3	Malaysia	OPL of Malaysia
4	Spanyol	Off Port Limit of Algeciras, Spain
5	Maroko	Off Port Limit of ceuta, Maroko
6	United Kingdom	London Outside of Port Limit, United Kingdom
7	Belanda	Amsterdam Off Port Limit
8	Perancis	France Off Port Limit
9	Las Palmas	Las Palmas OPL



Fig. 14. Indonesia anchorage (labuh jangkar) area [45].

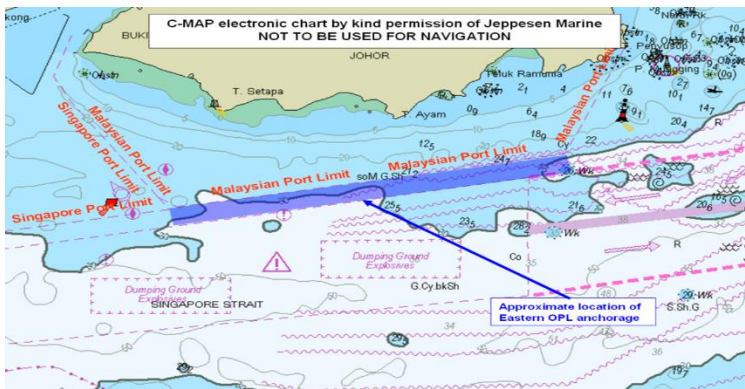


Fig. 15. EAST OPL Singapore [8].

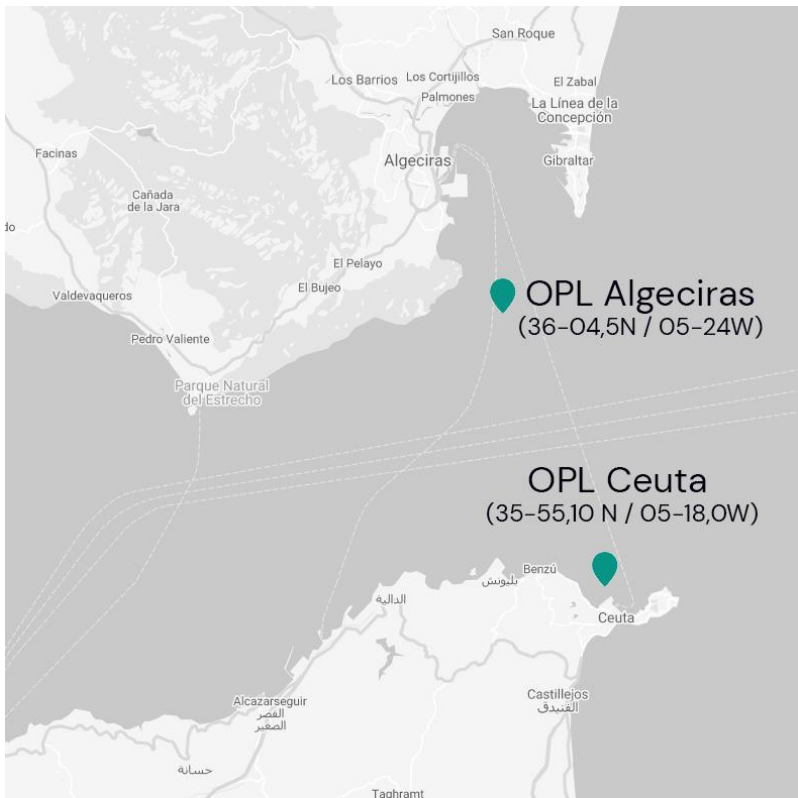


Fig. 16. Algeciras dan Ceuta Off Port Limit[46].

In this area, the countries that own the OPL have the same practice of port service activities in that area, namely providing port services when the ship docks to avoid pilotage fees and port fees. One of its activities is providing oil sludge discharge services from vessels.[47]

The misunderstanding that occurs in the area of eastern segment 2 which is considered OPL, is because there are OPL around the strait in the littoral states, namely the OPL of Indonesia, Malaysia, and Singapore. And OPL has not been regulated as a marine zone under UNCLOS as an international regulation. So, in this case an international regulation is needed regarding the existence of a new sea zone in the form of an area or a zone within the territorial sea of a country to be able to become an area for anchorage ships and ships to carry out oil discharge by providing facilities or services in the area and activities can be supervised by the Littoral State as has been practiced in various countries by establishing zones or areas in the form of outside of port limits but only based on the arrangements of each country as described above so as to cause misunderstanding of which OPL area is actually, while the OPL area can be used as a countermeasure so that there is no pollution due to the discharge of oil sludge from ships. Therefore, this marine pollution problem must be resolved immediately by forming a new maritime zone in the form of an OPL zone, which is regulated by international regulations, namely UNCLOS. And it is hoped that the three littoral states will immediately complete eastern segment 2, which is a grey area, so that it is not used as a location for illegal anchorage and illegal oil sludge discharge.

4 Conclusion

Marine pollution due to oil sludge occurs in the area considered as Outside of Port Limit, better known as OPL, and has been impacting the Bintan Coast, Indonesia, since 1970. The results show the area is the eastern segment of the 2 sections of the Singapore Strait, which is considered as OPL and is considered a grey area, identified based on satellite radar data. The marine pollution was the result of illegal dumping of oil sludge, as it was identified as visible on the sea surface and exceeded the MARPOL threshold. Under MARPOL the permitted discharge is 15 ppm for oil sludge discharge from the engine room and 30 ppm for oil sludge originating from cargo tanks or tank cleaning. The remaining oil sludge that is not discharged into the sea should be pumped and collected in storage tanks, then stored on board for disposal ashore or incinerated through port reception facilities or at OPL as practised by each country for ships that choose to anchor without having to dock at the port with pilotage fee and port charge free facilities provided. However, vessels often find the methods inefficient and costly, resulting in illegal dumping of oil sludge at sea. In this case, the misunderstanding of Eastern Segment 2 as an OPL area and being used as an anchorage area occurs because there are several OPL or anchorage areas that are also in the vicinity of the water area, namely in Indonesia, Malaysia, and Singapore. This is also because UNCLOS has not regulated the practice of OPL practices that have been carried out by several countries, so there is no regulation of this zone. The practice of vessels utilising OPL for anchoring is widespread in various countries to monitor vessel activities in OPL, countries establish designated OPL areas based on their respective practices. UNCLOS does not regulate the boundaries of harbours, OPL, or areas, so it is left to individual countries to establish their own harbour boundaries in accordance with national law. To address this issue international regulations, particularly in UNCLOS, were enacted to establish a new maritime zone in the form of an area or zone beyond port limits (OPL) for countries that have ports in these coastal countries where activities can be carried out under the supervision of the coastal state and there is no misunderstanding of which area is the OPL, so that ships do not arbitrarily anchorage and understand which area is the OPL. Thus, this will allow vessels anchored outside the working area and area of interest of the port to conduct oil discharge operations under supervision and such vessels have facilities to discharge oil sludge from their vessels. Efforts to regulate OPL by international arrangements through UNCLOS can help define port boundaries, allowing any port or coastal state to supervise these activities. This can be achieved through international agreements such as UNCLOS and IMO's Marine Environment Protection Committee (MEPC). The three coastal states of Indonesia, Malaysia and Singapore should immediately cooperate to resolve the Eastern Segment 2 by establishing maritime boundaries between their countries to promote cooperation and address marine pollution caused by illegal oil sludge dumping in the Eastern Segment 2, which is a grey area. As an alternative to waiting for the maritime boundary settlement to be finalised, it is suggested that Indonesia, Malaysia and Singapore as coastal states undertake the maritime boundary settlement. As an alternative to waiting for the maritime boundary to be finalised, it is recommended that Indonesia, Malaysia and Singapore as coastal states, undertake joint OPL management before maritime boundary delimitation in the eastern segment is finalised. So that when the maritime boundary in the eastern segment 2 is settled and OPL is regulated in UNCLOS by international regulation, this will make the sea area clear and pollution can be addressed and sustainable development can be realised.

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