ANNEX 10

RESOLUTION MEPC.396(82)
(adopted on 4 October 2024)

DESIGNATION OF THE NUSA PENIDA ISLANDS AND GILI MATRA ISLANDS IN LOMBOK STRAIT AS A PARTICULARLY SENSITIVE SEA AREA

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution from ships,

BEING AWARE of the ecological criteria, in particular relating to uniqueness or rarity, critical habitat, dependency, representativeness, diversity and fragility, and the social, economic and cultural, and scientific and educational criteria of the Nusa Penida Islands and Gili Matra Islands in Lombok Strait as well as their vulnerability to damage by international shipping activities and the steps taken by Indonesia to address that vulnerability,

NOTING the *Revised guidelines for the identification and designation of Particularly Sensitive Sea Areas* (*Revised PSSA Guidelines*), adopted by resolution A.982(24) as amended by resolution MEPC.267(68), and the *Revised guidance document for submission of PSSA proposals to IMO* set forth in MEPC.1/Circ.510,

HAVING AGREED that the criteria for the identification and designation of a Particularly Sensitive Sea Area (PSSA) provided in the Revised PSSA Guidelines are fulfilled for the Nusa Penida Islands and Gili Matra Islands in Lombok Strait,

HAVING NOTED that the Lombok Strait includes newly established routeing systems (Traffic Separation Scheme (TSS)), adopted by the Maritime Safety Committee, at its 101st session, as the Associated Protective Measures to improve the safety of navigation and the protection of the marine environment, and that the TSS entered into force on 1 July 2019,

1 DESIGNATES the Nusa Penida Islands and Gili Matra Islands in Lombok Strait, as defined in annex 1 to the present resolution, as a PSSA;

2 INVITES Member Governments to recognize the ecological, socio-economic and scientific criteria of the Nusa Penida Islands and Gili Matra Islands in Lombok Strait, set forth in annex 2 to the present resolution, as well as their vulnerability to damage by international shipping activities, as described in annex 3 to the present resolution;

3 ALSO INVITES Member Governments to note the Associated Protective Measures established to address the area's vulnerability, the details of which are contained in annex 4 to the present resolution.

ANNEX 1

DESCRIPTION OF THE NUSA PENIDA ISLANDS AND GILI MATRA ISLANDS IN LOMBOK STRAIT PARTICULARLY SENSITIVE SEA AREA[1]

Description of the Particularly Sensitive Sea Area

To minimize the risk of damage from ship groundings and pollution damage by international shipping activities, to protect the area's unique and endangered species, and to safeguard its critical habitat and diversity as well as significant economic and cultural resources, mariners should exercise extreme care when navigating in the area bounded by the geographical coordinates of the Particularly Sensitive Sea Area, provided below, and adhere to the Associated Protective Measures set out in annex 4.

The geographical coordinates of the Nusa Penida Islands and Gili Matra Islands in Lombok Strait Particularly Sensitive Sea Area are provided in tables 1 and 2 below; the location code and numbered list refer to figure 1. All geographical positions are based on WGS 84.

Table 1. Geographical coordinates of proposed PSSA Nusa Penida Islands in the Lombok Strait.

Location Code	Latitude	Longitude
A	8° 39' 14.43" S	115° 34' 37.10" E
B	8° 46' 25.54" S	115° 39' 41.36" E
C	8° 51' 39.59" S	115° 35' 32.77" E
D	8° 45' 46.33" S	115° 26' 06.53" E
E	8° 41' 05.82" S	115° 24' 13.28" E
F	8° 38' 34.63" S	115° 26' 42.52" E

Table 2. Geographical coordinates of proposed PSSA Gili Matra Islands in the Lombok Strait.

No.	Latitude	Longitude
1	8° 19' 51.00" S	116° 1' 23.00" E
2	8° 20' 34.00" S	116° 5' 42.00" E
3	8° 22' 28.00" S	116° 5' 29.00" E
4	8° 21' 59.00" S	116° 1' 11.00" E

[1] The text in this annex is taken from the information provided by Indonesia in document MEPC 82/12.

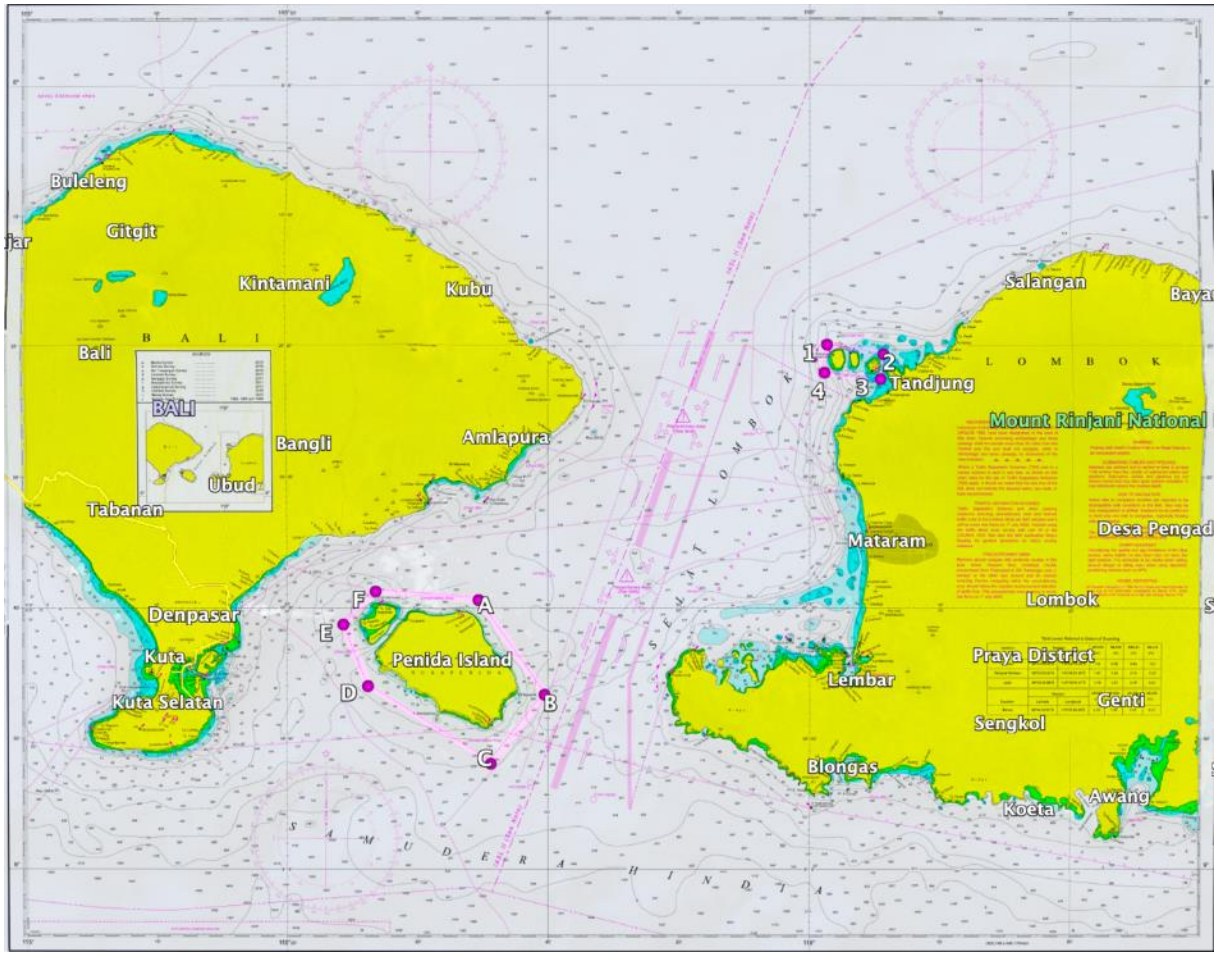


Figure 1: Map showing the location of the Nusa Penida Islands and Gili Matra Islands in Lombok Strait Particularly Sensitive Sea Area

ANNEX 2

ECOLOGICAL AND SOCIO-ECONOMIC CRITERIA OF THE NUSA PENIDA ISLANDS AND GILI MATRA ISLANDS IN LOMBOK STRAIT PSSA[1]

1 Introduction

The Lombok Strait

1.1 The Lombok Strait (in Indonesian: Selat Lombok), connects the Java Sea to the Indian Ocean, and is located between the islands of Bali and Lombok in Indonesia. The narrowest point of the Strait is at its southern opening, with a width of 18 km between the islands of Lombok and Nusa Penida. At the northern opening, it is around 30 km across with the Gili Islands on the north-west side of Lombok. The depth of the Lombok Strait reaches 250 metres; therefore, it is more suited to crossing large vessels if compared to the Malacca Strait which is only 200 metres in depth.

1.2 The Lombok Strait has significant traffic density of ships which serve national and international traffic at the IASL-II. Based on AIS data collected from Benoa VTS in 2023, the number of vessels passing through the Lombok Strait was 4,885 from a total of 77,147 trips. Those numbers are made up by the trips of IASL-II, inland ferries and fishing vessels, etc. The proportion of cargo vessels and tankers is 11% (8,791 trips) and 17% (13,028 trips), respectively.

1.3 The PSSA covers an area around the Nusa Penida Islands and the Gili Matra Islands. Nusa Penida is located south-east of Bali Island while the Gili Matra Islands are north-west of Lombok Island (see figure 1). The coordinates of the proposed PSSA of the Nusa Penida Islands and Gili Matra Islands in Lombok Strait are set out in annex 1.

Nusa Penida and Gili Matra ecosystem

1.4 The Nusa Penida Marine Protected Area (MPA), which covers Nusa Penida Island, Nusa Lembongan Island and Nusa Ceningan Island, was established in 2014 via Ministerial Decree Number 24/Kepmen-KP/2014 and subsequently expanded in 2018 (Decree Number 90/KEPMEN-KP/2018). It has a high biological diversity, with approximately 1,419 hectares of coral reefs and 296 coral species within the Coral Triangle, which is currently a world priority to preserve. The Nusa Penida MPA has in its area coral reefs, mangroves, sea grass meadows and almost all the important habitats of fish resources, including the manta ray (*Manta birostris*), and marine mammals such as whales and dolphins, across this region. Nusa Penida is famous for manta rays and Mola mola (also known as the ocean sunfish). In addition, there are two types of turtles, the green turtle and the hawksbill turtle. This area is also a known sunfish "cleaning" site, a place for deep-sea fish to surface and clean their bodies of parasites. The existence of this unique fish species is an important cultural symbol for local communities of Klungkung Regency, Bali Island.

1.5 The Gili Matra archipelago consists of three islands namely Gili Meno, Gili Ayer and Gili Trawangan and was formally established as a national MPA in 2009 (Ministerial Decree Number 67/Kepmen-KP/2009). This designation was reaffirmed and expanded upon in 2022 (Decree Number 34) by the Minister of Marine and Fisheries. The coral reef types surrounding the three islands are fringing reefs and these ecosystems are the main focus of marine tourism. The area of coral reefs in the three islands is 696.09 ha, that is 287.02 ha in Gili

[1] The text in this annex is drawn from the information provided by Indonesia in document MEPC 82/12. All references used in this resolution are set out in document MEPC 82/12.

Trawangan, 175.59 ha in Gili Meno, and 233.48 ha in Gili Ayer. Based on the biodiversity of coral reefs and the estimated number of all types of fish in the three islands, 1,664 individuals of target fish or the equivalent of 3,658 individuals can be found per hectare consisting of 54 species and nine tribes (Ministry of Marine Affairs and Fisheries, 2020).

1.6 Sea grass meadows provide some valuable ecosystem services of any marine habitat, such as those that store carbon, improve water quality, provide food and habitat, and act as biological indicators and spawning areas for several marine species (Short et al., 2016). The size of sea grass meadows in the three islands is 58.5 ha, that is 14.39 ha in Gili Trawangan, 32.83 ha in Gili Meno and 11.28 ha in Gili Ayer (Ministry of Marine Affairs and Fisheries, 2020). Among the three islands, Gili Meno is the favourite island for nesting sites for turtles and turtle foraging (feeding grounds), since it is covered with sea grass for more than half of its circumference.

1.7 In addition to these MPAs, the east coast of the island of Bali and the west coast of the island of Lombok support significant tourism operations. In 2022, after the COVID-19 pandemic had subsided, Klungkung Regency, including Nusa Penida, welcomed around 728,936 tourists from January to mid-December 2023. This number had increased compared to 2022, which saw only 312,872 tourists, whereas the number of tourist visits to North Lombok reached 278,519 in 2022 and increased significantly to 656,448 in 2023. Gili Matra, especially Gili Trawangan, contributes to the number of tourist visits in North Lombok with a total of 96% (Department of Tourism, North Lombok, 2022; Information and Documentation Management Officer, North Lombok, 2023).

2 Ecological criteria

Uniqueness or rarity

2.1 A 2008 Rapid Ecology Assessment by Gerry Allen and Mark Erdmann highlighted the astounding biodiversity of Nusa Penida's waters, revealing a remarkable 576 fish species. Among these is the Mola mola, or ocean sunfish, one of the world's largest bony fish. These elusive giants inhabit the deep-sea, reaching depths of 400 metres (Nyoman Darma et al., 2010). Notably, Nusa Penida is one of the rare locations globally where Mola mola are known to surface to clean themselves from various parasites with the help of reef fish as well as sunbathing to get sunlight to adjust body temperature due to being in the deep-water for a long time, making it a haven for marine life enthusiasts (CTC, 2019).

2.2 Nusa Penida's marine life extends beyond the Mola mola. Divers can also encounter a fascinating array of rays, including manta rays, frequently sighted near Batu Lumbung (Batu Kandik Village), which is also called Manta Point and, known as one of the three major manta sightseeing locations in Indonesia (Sari Hani, 2021). Records indicate sightings of up to eight manta rays at a time (Nyoman Darma et al., 2010). This marine life shares the waters with other threatened species classified as "Vulnerable" by the International Union for Conservation of Nature (IUCN). As detailed in table 1, the IUCN Red List of Threatened Species (www.iucnredlist.org) identifies several fish and turtle populations in Nusa Penida and Gili Matra facing vulnerability or endangerment.

Table 1: **IUCN Conservation Status for some species found in Nusa Penida.**

No	Species	Species Name	IUCN Conservation Status
1	Sunfish	• *Mola mola* • *Mola alexandrini (previously known as Mola Ramsayi)*	Vulnerable Unrecorded
2	Manta rays	*Manta birostris*	Endangered
3	Lumba-lumba hidung botol (*bottle nose*)	*Tursiops truncates*	Endangered
4	*Penyu sisik* (Hawksbill)	*Eretmochelys imbricata*	Endangered
5	*Penyu hijau* (Green Turtle)	*Chelonia midas*	Endangered
6	False killer whale	*Pseudorca crassidens*	Near threatened

Critical habitat

2.3 According to the Coral Reef Rehabilitation and Management Program – Coral Triangle Initiative, Asian Development Bank (COREMAP CTI ADB) conducted by the Indonesia Climate Change Trust Fund (ICCTF) and Ministry of National Development Planning Agency National Development Planning Agency in 2023, Nusa Penida Island, Nusa Lembongan Island and Nusa Ceningan Island have exceptionally high marine biodiversity. In the region, there are 1,419 hectares of coral reef, 230 hectares of mangrove forests, and 108 hectares of seagrass beds (Sari Hani, 2021) with more than 296 coral reef species and some 576 reef fish species, five of which are categorized as newly discovered species (Coral Triangle Center, 2011). The fringing coral reefs provide a critical habitat for marine biota hatching and serve as habitat for reef associated marine biota such as coral fish, shrimp, mollusca and various marine invertebrates (Hutomo and Moosa, 2005).

2.4 Nusa Penida Islands are also home to many residential and migratory cetacean species providing critical habitats. Species include the bottlenose dolphin (*Tursiops truncates*), the pantropical spotted dolphin (*Stenella attenuate*), and the spinner dolphin (*Stenella longirostris*). The deep seas of the Strait of Lombok form an important migratory route between the Pacific and Indian Oceans for whales, including the endangered blue whale (*Balaenoptera musculus*) and the vulnerable fin (*Balaenoptera physalus*) and humpback (*Megaptera novaeangliae*) whales. The presence of these species is providing a growing whale shark and dolphin watch industry in the Bali-Lombok waters including near Nusa Penida.

2.5 Gili Matra Islands serve as a critical habitat for manta rays and mobula rays. However, these magnificent creatures face significant threats. The IUCN Red List classifies *Mobula birostris* (giant manta ray) as "vulnerable" due to a concerning global population decline (Ministry of Marine Affairs and Fisheries, 2020). A similar fate befalls *Mobula alfredi* and *Mobula kuhlii*, both categorized as vulnerable due to dwindling populations. There is a Protection Zone covered 7.44 hectares in Gili Matra MPA, the purpose of which is to protect critical habitats, notably the blue coral colonies (Heliopora sp.) that occupy the shallow waters of Gili Matra (Rahmadyani et al., 2022).

Dependency

2.6 Nusa Penida's rich biodiversity of ecosystems, consisting of vibrant coral reefs, flourishing mangrove forests and extensive seagrass meadows, fosters a remarkable diversity with significance for resident and migratory cetacean species.

2.7 Bali Island, particularly through Nusa Penida, gracing the southern edge of the Coral Triangle, sits within the Lesser Sunda Ecoregion. This vital region serves as a major migratory corridor for cetaceans, facilitating the movement of 22 marine mammal species, including giants like blue and sperm whales, between the Indian and Pacific Oceans (Reef Resilience Network, 2022).

Representativeness

2.8 Indonesia's coral reefs account for 65% of the total area in the Coral Triangle, and Lombok Strait along with Nusa Penida and Gili Matra are included as part of the Coral Triangle Initiative on Coral Reefs, Fisheries and Food Security (CTI-CFF) along with Malaysia, Papua New Guinea, the Philippines, Solomon Islands and Timor-Leste. The region sits within the heart of the Coral Triangle, a global hot spot of marine biodiversity. It boasts a stunning array of coral reefs, diverse marine life like manta rays and sea turtles, and unique geological formations. These islands exemplify the ecological richness of the Coral Triangle, making it a crucial area for conservation and a captivating destination for nature enthusiasts.

Diversity

2.9 Nusa Penida boasts exceptional biodiversity, exemplified by its extensive coral reefs. Encompassing a remarkable 1,419 hectares, these fringing reefs teem with life. A staggering 296 coral species and 576 fish species thrive in the shallow waters surrounding this 200-square kilometre island. Notably, live coral cover thrives, ranging from 70% to 75%, with a healthy balance between hard coral (averaging 40.3%) and soft coral (averaging 29.8%). Among the dominant coral genera are Acropora sp. and Montipora sp. for hard corals, and Xenia, Nephthya, and Sinularia for soft corals (Nyoman Darma et al., 2010). This vibrant coral ecosystem provides a haven for a diverse array of marine life, including sea anemones, algae, clams (tridacna), crinoids and starfish (linckia).

2.10 Nusa Penida Islands are positioned at the southern end of the Lombok Strait, which is within the "Coral Triangle", a centre of rich marine biodiversity. Coral Triangle is home to 76% of all known coral species, 37% of all known coral reef fish species, and 53% of the world’s coral reefs. The area is of ecological and scientific significance and has great natural beauty and diversity, as seen in its pristine islands and reefs. The Lombok Strait provides a multitude of transitional zones to the land, the sea and the freshwater environment, which is the basis for exceptional biodiversity.

2.11 Gili Air, Gili Meno and Gili Trawangan are surrounded by ecosystems coral reefs. The type of coral reef that covers the three islands morphologically is fringing coral reef covering 696.09 ha of coral reef. Coral reefs in Gili Matra are home for 1,664 individuals of fish target or equivalent to 3,658 individuals per hectare consisting of 54 types and nine tribes. Gili Matra is also very well known as an ecosystem for seagrass meadow. Seagrass meadow has a 12.2 ha area consisting of seven species (Ministry of Marine Affairs and Fisheries, 2020).

2.12 Blacktip shark and whitetip shark can be found in the Gili Water Tourism Park (TWP). In this conservation area, these fish are an attraction for tourists. Apart from that, many turtles can also be found, especially green and hawksbill turtles (Ministry of Marine Affairs and Fisheries, 2020).

Productivity

2.13 The Lombok Strait and Nusa Penida region are characterized by a unique upwelling phenomenon. This process brings cooler water to the surface, lowering sea surface temperature and enriching the environment with phytoplankton, as evidenced by increased

chlorophyll-a concentrations (Chl-a) (Tito and Susilo, 2017). This abundance of phytoplankton likely serves as a vital food source for gelatinous zooplankton, which in turn attracts the majestic ocean sunfish (Mola mola) – a key player in marine ecosystems due to its consumption of these zooplankton. The upwelling process further enhances the ecological significance of the area by attracting a wider range of large pelagic predators, including sharks and rays.

Spawning

2.14 Both Nusa Penida and Gili Matra, positioned within the Coral Triangle, hold immense significance as critical spawning grounds and nursery areas for a diverse array of marine life. The warm, nutrient-rich waters, diverse underwater structures and abundant food sources lay the foundation for the breeding of marine life. Some examples include manta rays, mobula rays, sunfish, green sea turtles, and a variety of reef fish species which all utilize Nusa Penida's waters for spawning and raising young in Nusa Penida (ICCTF, 2023).

2.15 The fringing coral reef ecosystem encircling Gili Matra plays a critically important role, particularly for a small island ecosystem. Due to its isolated nature, any disruption to this reef's functions has immediate consequences. The reef serves as the foundation of Gili Matra's biodiversity, providing essential ecosystem services. It acts as a nursery, habitat, and feeding ground for a vast array of marine life (Rahmadyani et al., 2022). This interconnectedness is exemplified by green sea turtles, which find Gili Matra's beaches ideal for nesting. The surrounding coral reef waters then nurture the young hatchlings as they mature (ICCTF, 2023).

Naturalness

2.16 Nusa Penida is a relatively remote island off the coast of Bali, with limited roads and infrastructure compared to the more developed mainland. This remoteness has helped preserve its natural beauty and reduce direct human impact. While tourism is increasing, tourism activities are strictly controlled to minimize impacts on the natural environment. There is a natural ecosystem in the waters of Nusa Penida, including on Virgin Island, which is maintained naturally. One example is the existence of Virgin Beach, which still has very clear water. The clear water at Virgin Beach is because this beach has not been touched much and has not been changed by interference from human hands.

2.17 Gili Matra's tourism industry prioritizes eco-friendly and sustainable practices, emphasizing waste reduction and environmental protection. This commitment ensures tourism does not significantly compromise the island's pristine character. A prime example lies in the ban on motorized vehicles across the three islands. Visitors may explore Gili Matra's charm on foot, by bicycle or via traditional horse-drawn carriages, fostering a deeper connection with the natural environment (ICCTF, 2021).

Integrity

2.18 Nusa Penida's status as an MPA necessitates effective zoning strategies. A crucial component of maintaining marine ecosystem integrity is designating dedicated sustainable fisheries zones, which help regulate fishing pressure and promote responsible practices.

2.19 Gili Matra embodies a unique geography, classified as a semi-open inner island and a coral island. This translates to a landmass fringed by a vibrant coral reef ecosystem (Kurniawan et al., 2016). The reef's rich marine biodiversity and stable seabed play a critical role in safeguarding the Gili Matra Islands, acting as a natural barrier and promoting long-term island stability.

Fragility

2.20 The vital Lombok Strait faces significant environmental threats from shipping activities. Oil spills, marine debris, accidental grounding, and anchor damage pose a constant risk. Coral reefs, classified as highly sensitive based on vulnerability indices (environmental sensitivity index value), are particularly susceptible to collision with ship hulls (Dewi et al., 2023). These threats underscore the urgency of implementing robust conservation measures to safeguard Nusa Penida's delicate ecosystem from the perils associated with international shipping in the Lombok Strait.

2.21 The Gili Matra MPA is characterized by a critical yet imperilled coral reef ecosystem. This vital underwater world faces significant threats, leading to a concerning decline in biodiversity. Symptoms of this degradation include a reduction in overall fish biomass, particularly in commercially targeted species. Additionally, encounters with the exotic marine fauna that define the Gili Matra experience have become less frequent (Rahmadyani et al., 2022).

3 Social, cultural and economic criteria

Social or economic dependency

3.1 Nusa Penida and Gili Matra is heavily dependent on marine tourism. Nusa Penida's coastal area is intensively used for economic activities such as seaweed farming, marine tourism and fisheries. Nusa Penida has 20 dive spots around Nusa Penida Island and 308 hectares of seaweed farming area with an average production of about 50 tons/month (Ruchimat et al., 2013).

3.2 Nusa Penida is one of the most popular marine tourism destinations in Bali. Marine tourism businesses in the Nusa Penida area are scuba and snorkelling, surfing, cruise and sailing and water sports (Rikardi et al., 2021). Based on data from the Klungkung Bali Tourism Office, the number of tourist visits to Nusa Penida reached 700,000 tourists by the end of 2023.

3.3 Gili Matra is a globally attractive marine tourism destination, bringing about 500,000 tourists yearly. The tourism revenue of Gili Matra contributes up to 70% of the North Lombok economy. More than 50% of the Gili Matra population works in activities related to the tourism industry. In addition, it also creates substantial employment opportunities for mainland communities (North Lombok District) (Rahmadyani et al., 2022).

Human dependency

3.4 The waters of the Nusa Penida area and its surroundings are part of the waters of the eastern region of Bali, which serve as a fishing ground for a lot of fishers, not only for local fishers but also for fishers from different regions such as Lombok, Sulawesi and Banyuwangi (Rikardi et al., 2021).

3.5 The major commodities are tuna, skipjack, snapper, grouper and mackerel. Nusa Penida's capture fisheries production is around 93,713 tons/year (2007), 103,378 tons/year (2008) and 105,469 tons/year (2009). Capture fisheries production in Nusa Penida is 919 tons, for tuna which has a value of IDR 9,462,473,000 or 45.2% of Klungkung Regency's fish production (CTC, 2018).

3.6 Apart from fish production, the Nusa Penida area also produces seaweed, which contributes 99.34% of the seaweed production in the Bali region (Department of Marine Affairs and Fisheries Denpasar, 2017).

Cultural heritage

3.7 The traditional structure that overlooks Pakraman villages in Nusa Penida is the Alit Assembly. The assembly coordinates, performs and supervises religious and customary rituals. The community of Nusa Penida also performs the Nyepi Segara ritual every year to honour the sea. The ritual is usually held on Sasih Kapat, which falls in October. During Nyepi Segara, fishing activity in the sea is not allowed for a full day (Ruchimat et al., 2013).

3.8 In Balinese and Lomboknese culture, mountains, lakes, *campuhan* (river confluence), beaches and seas are believed to have sacred values. Therefore, temples and holy places are generally built in those places, because in those places that is where holy people and Hindus have holy thoughts (revelations). In Nusa Penida there are several Kahyangan Jagat Temples, which are not only celebrated by the people on the island but also by the Hindu community throughout Bali. There are 15 temples in Nusa Penida, one of the largest being Sad-Khyangan Ped Temple, which is one of the central temples on the island of Bali. There are several large temples in Nusa Penida such as Batu Medau Temple and Giri Putri Temple. The highest peak in Nusa Penida, namely Puncak Mundi, also has a temple which is usually used by the people of Nusa Penida and the island of Bali for praying (Department of Marine Affairs and Fisheries Denpasar, 2017).

3.9 Apart from being known for their natural beauty, Bali and Lombok are also areas that apply strong religious principles, local wisdom and a philosophy of life. One of the principles that is widely known by the local community is Tri Hita Karana (three reasons for prosperity), which is based on efforts to maintain harmony with God, with fellow humans and with nature or the environment. This principle was then revealed in the form of an effort to maintain the purity of the six elements (Sad Kertih), namely *segara* (ocean), *wana* (forest), *danu* (lake), *jagat* (universe), *jana* (body) and *atma* (soul). This religious principle is a strong justification for efforts to protect the environment, especially the marine environment in the Bali region. (Wiana, 2018).

4 Scientific and educational criteria

Research

4.1 The Lombok Strait is one of the main exit routes for the Indonesian Throughflow (ITF) which connects Indonesian waters with the Indian Ocean. This strait is also an extraordinary Indonesian water zone because of the internal tides which often develop into internal solitary waves (Purwandana et al., 2021). There has been a lot of research on the characteristics of internal tides that occur in the Lombok Strait to find out the potential energy from ocean currents that can be converted into electrical energy.

4.2 ITF also produces upwelling from cooler seawater moving from the sea floor deeper to the surface and can produce strong currents when combined with tides. The presence of local currents and upwelling events makes Nusa Penida a suitable area for studying the relationship between oceanographic characteristics and fish shape. Oceanographic characteristics, including changes in sea surface temperature and current speed caused by vertical mixing, influence the distribution of coral reef fishery species on Nusa Penida. Research relating to the relationship between oceanographic characteristics and fish species will provide important information in decisions regarding marine spatial planning. Therefore, marine spatial planning in the Lombok Strait, especially Nusa Penida, is important (Sartori et al., 2021). Nusa Penida as an MPA also has two core zones where only researchers with certain permits are allowed to enter (Ruchimat et al., 2013). One core zone is located only two nm from the outer line of the western side of TSS Lombok Strait.

4.3 The Lombok Strait is also a biogeographic boundary between the fauna of western Indonesia and eastern Indonesia, which have very clear differences. Alfred Russell Wallace, a zoologist from England discovered this difference in his research and then drew an abstract dividing line called the Wallace Line from the South Philippines, the Sulawesi Strait, to the Lombok Strait (Desmonda, 2020; Van Welzen et al., 2011). Apart from that, research related to flora and fauna was also carried out on Nusa Penida.

4.4 Apart from being a research centre in the fields of ecology, flora, fauna and electric current energy potential, the land area in Nusa Penida has also been designated as a source area for breeding Bali cattle. Determination of Nusa Penida as a source area for Bali cattle breeding based on Decree of the Minister of Agriculture of the Republic of Indonesia No. 346 of 2016. Bali cattle as a native Indonesian livestock breed have been designated through Decree of the Minister of Agriculture Number 325/kpts/OT.140/1/201.

4.5 Sharks in Gili Matra at this location are one of the objects of research projects from various institutions. There are two types of sharks commonly found in Gili Matra, namely blacktip reef shark (*Carcharhinus melan-opterus*) and whitetip reef shark (*Triaenodon obesus*) (Ministry of Marine Affairs and Fisheries, 2020).

Baseline for monitoring studies

4.6 Gili Matra is also a location for satellite-based monitoring of turtle movements. This monitoring is important for providing technical recommendations for the management of conservation areas to have better insight into animal welfare and the sustainability of the ecosystem that supports the life of turtles on Gili Matra.

Education

4.7 Several sub-zones designed in the Nusa Penida MPA are zones intended for education. This educational activity supports the interests of water conservation in Nusa Penida. In 2020, Nusa Penida was designated a Hope Spot by Mission Blue. Hope Spots is a campaign that embraces unique ecological areas in the ocean and is designed for global protection and conservation campaigns. Furthermore, this MPA serves as a living laboratory for studying marine conservation and management methods on the ground (CTC, 2019).

4.8 Gili Matra has been used as a place for diving coaching and training. This activity was carried out at the diving school on Gili Trawangan, Lombok. This activity involved 15 participants seeking to obtain an international diving certificate by Scuba School International, which involved representatives from the ecotourism group, supervisory groups and representatives of marine conservation area managers at the Gili Matra MPA; it is noteworthy that 9 out of 15 participants in this training were women. This activity aims to support human resources so that people can become marine tourism guides who have ecotourism principles and improve the economy and a sustainable ecosystem.

ANNEX 3

VULNERABILITY TO DAMAGE BY INTERNATIONAL SHIPPING ACTIVITIES[2]

1 Vessel traffic characteristics

Operational factors

1.1 Fishing vessels, traditional vessels, local trade vessels, tourist and recreational craft can be encountered anywhere in the Lombok Strait, especially in the vicinity of the Nusa Penida Islands. There are currently no existing activities or foreseeable developments of offshore exploration or exploitation of the seabed.

1.2 One zone in Nusa Penida MPA, called a sustainable fisheries zone, is dedicated to traditional fisheries. This zone aims to protect fish habitat and populations, fishing using environmentally friendly tools and methods, tourism and recreation, research and education. Some environmentally sustainable methods of fishing such as bottom-line fishing, trawling line fishing, set net fishing, and free diving with spear fishing are allowed under the provision that any fauna, such as sharks, ocean sunfish, manta ray and endangered species, must be released. Shipping (cruising) is still allowed in this zone. Nusa Penida MPA also has two core zones where only researchers with certain permits are allowed to enter (Ruchimat et al., 2013).

1.3 The Core Zone in the Gili Matra MPA, which covers 94.81 ha of water, is a no-entry zone specifically designated to preserve marine habitat and populations. Except for research or educational purposes, utilization or extraction activities are not permitted in the zone.

Vessel types

1.4 Table 1 below provides a comprehensive overview of the number of vessels in each ship type traversing the Lombok Strait throughout 2023. Among the various vessel categories, passenger ships dominate the maritime traffic with a substantial count of 24,489, indicating the high volume of passenger transportation and maritime travel within the area of Bali and Lombok. In addition, pleasure boats also are seen to have a high traffic volume with 1,793 trips made. General cargo ships are also prominently represented, totalling 12,964 trips, underscoring the importance of goods transportation through this strategic waterway. Slightly less are the trips made by oil product tankers, which contributed to the maritime traffic with a substantial count of 8,772.

Table 1: Number of each ship type traversing the Lombok Strait in 2023

Ship type	Number of passing vessels
Chemical tanker	9
Crude oil tanker	10
Oil products tanker	8,772
Gas tanker	47
General cargo ship	12,964
Bulk carrier	528
Container ship	64
Other ship	5,654
Passenger ship, Passenger ship, Fast ferry	25,014

[2] The text in this annex is drawn from the information provided by Indonesia in document MEPC 82/12.

Ship type	Number of passing vessels
Pleasure boat	12,793
Support ship	8,382
Fishing ship	2,910

Traffic characteristics

1.5 According to the Indonesian Law Number 6 Year 1996 on Indonesian Waters and Government Regulation Number 37 Year 2002 on Rights and Obligations of Foreign Ship and Aircraft Exercising Archipelagic Sea Lanes Passage in Designated Archipelagic Sea Lanes, Lombok Strait is designated as IASL-II. This Strait serves as a domestic and international sea lane and is also crossed by ferries between Bali and Lombok Islands. The IASL was adopted by IMO through resolution MSC.72(69) in 1998.

1.6 Indonesia, as the Archipelagic State, has the rights to prescribe the TSS to enhance the safety of navigation on the Archipelagic Sea Lane, based on Article 53(6) of United Nations Convention on the Law of the Sea (UNCLOS) 1982 and also based on IMO's General Provisions for the Adoption, Designation and Substitution of Archipelagic Sea Lanes. The designation of the TSS will affect the ships which exercise the rights of Archipelagic Sea Lane Passage in the Lombok Strait.

1.7 The traffic in the Lombok Strait, as shown in figure 1, is comprised of the following vessel types: 11.5% tankers, 16.9% cargo ships, 32.6% passenger ships, 16.7% pleasure vessels, 10.9% support vessels, 3.8% fishing vessels, and other types of ships about 7.4% (LCT, barges, research vessels, etc.). The traffic pattern of IASL-II is obtained from the AIS data and shown in figure 2 below. The number of ships is obtained from the Benoa VTS data and other data which is reported by several local ports in the area of Lombok Strait (IASL-II). The number of voyages collected during 2023 in the vicinity of Lombok Strait, including IASL-II and several inland traffics movement, amount to 77,147 trips, which can be translated as 257 trips daily. This figure on a daily average basis consists of 37 navigating in the IASL-II and 220 trips made by either passenger ship, support vessel or others.

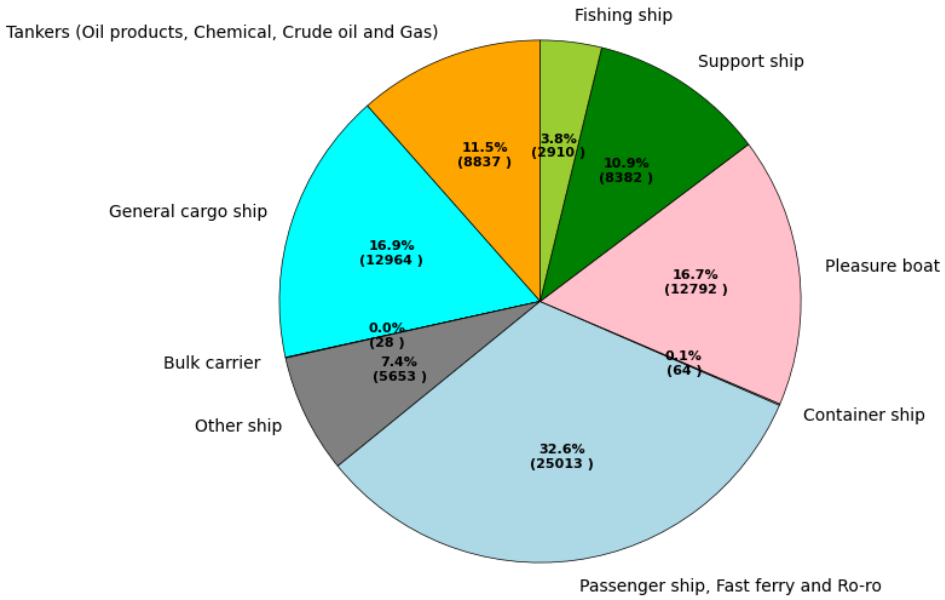
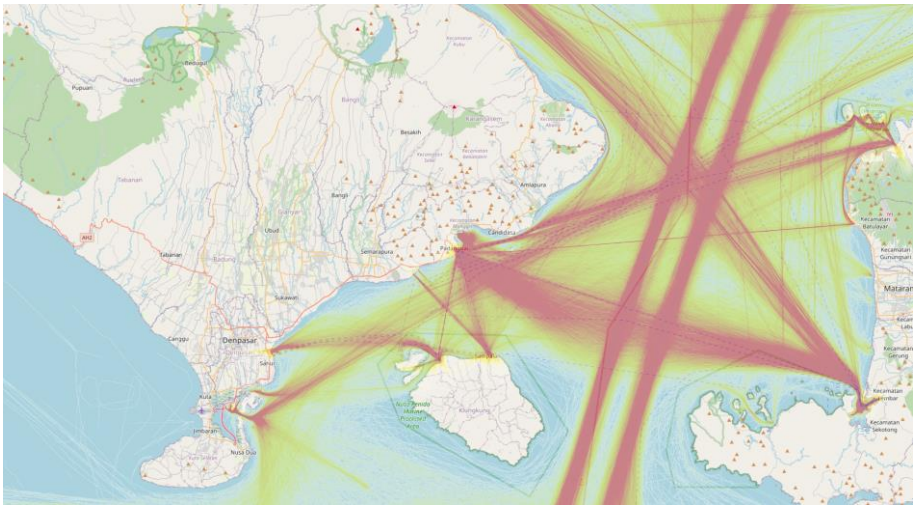
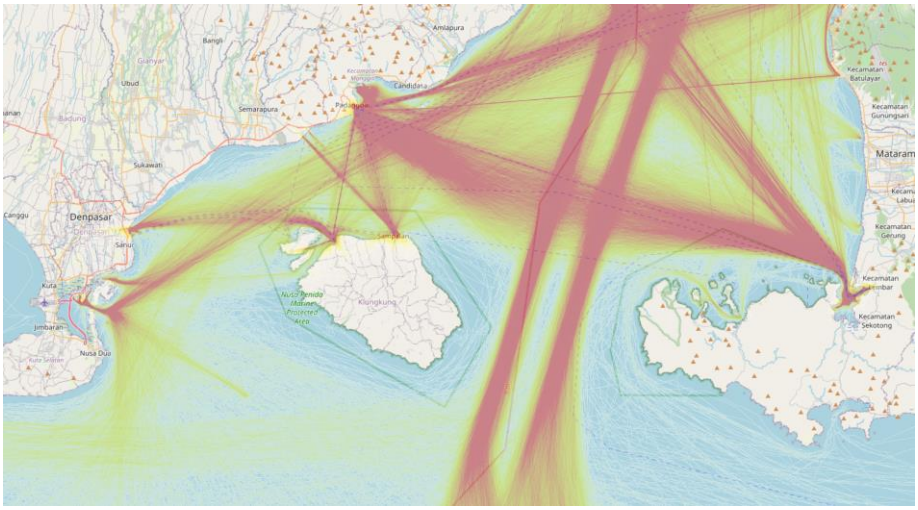


Figure 1: **The proportion of the traffic in the Lombok Strait by vessel types**

1.8 As shown in figure 2 (a-c) below, along with the existence of IASL-II in the Lombok Strait there is also a high-density crossing traffic line between Bali Island and Lombok Island that intersects IASL-II. This crossing traffic consists mainly of passenger ferry ro-ro and pleasure vessels as both Bali and Lombok Islands are well known as tourism destinations.



(a)



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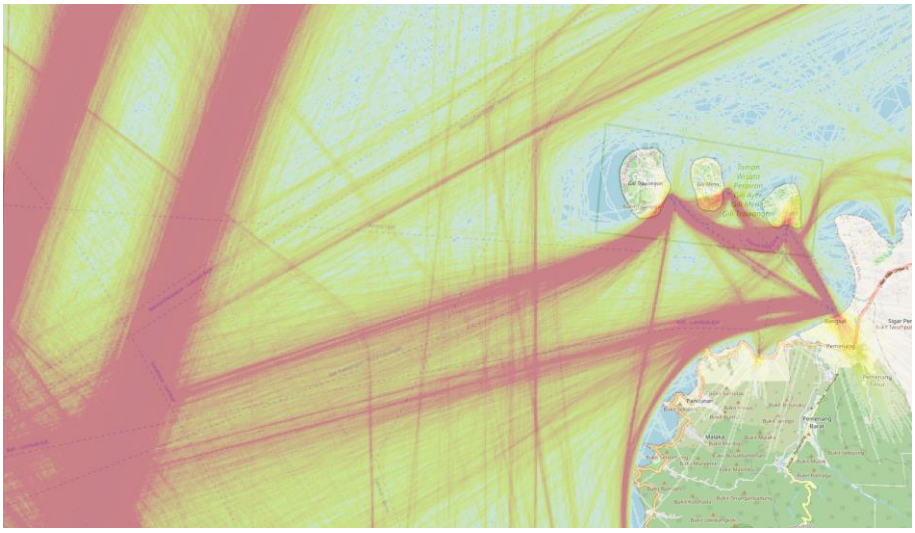


(c)

Figure 2: Traffic patterns in (a) Lombok Strait, (b) around Nusa Penida Islands, and (c) around Gili Matra Islands

1.9 The location of the TSS Lombok Strait, which is less than one nautical mile from the outer edge of Nusa Penida MPA, could pose a danger to the marine environment due to grounding or drifting. As shown in figure 3, it is found that the closest distance of ship trajectory to the core zone of Nusa Penida is MPA is only 0.6 NM. This is because the regulation of MPA does not forbid the activity of any passing vessel. While the traffic distribution in IASL-II is following a normal distribution (see figure 4).

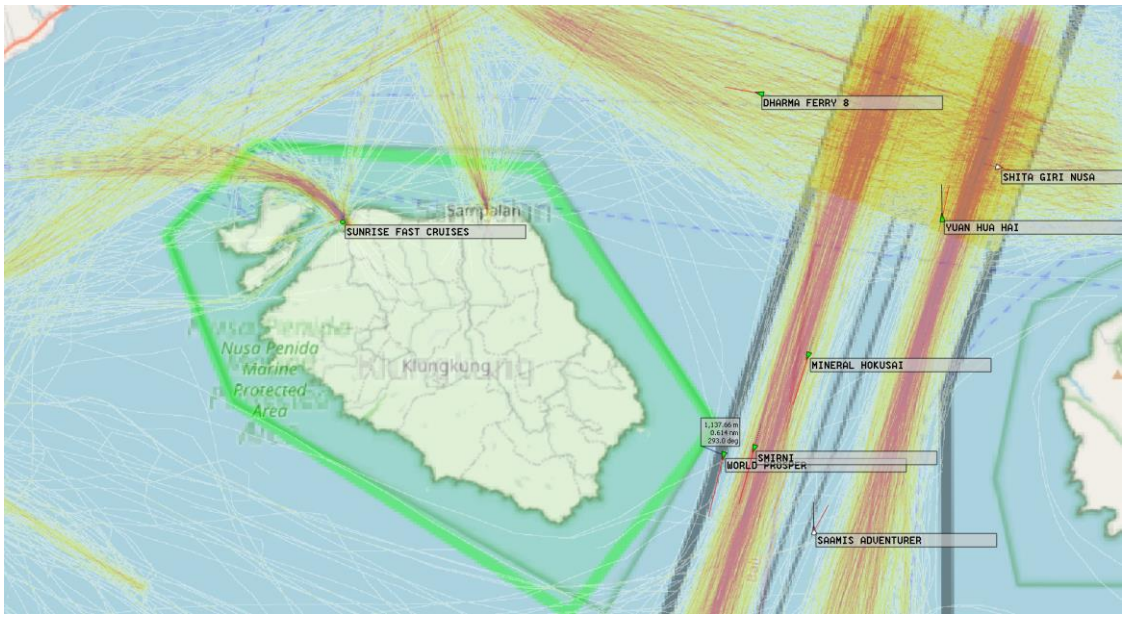


Figure 3: The closest distance of ship trajectory to the core zone of Nusa Penida MPA is approximately 0.6 NM or 1,100 m

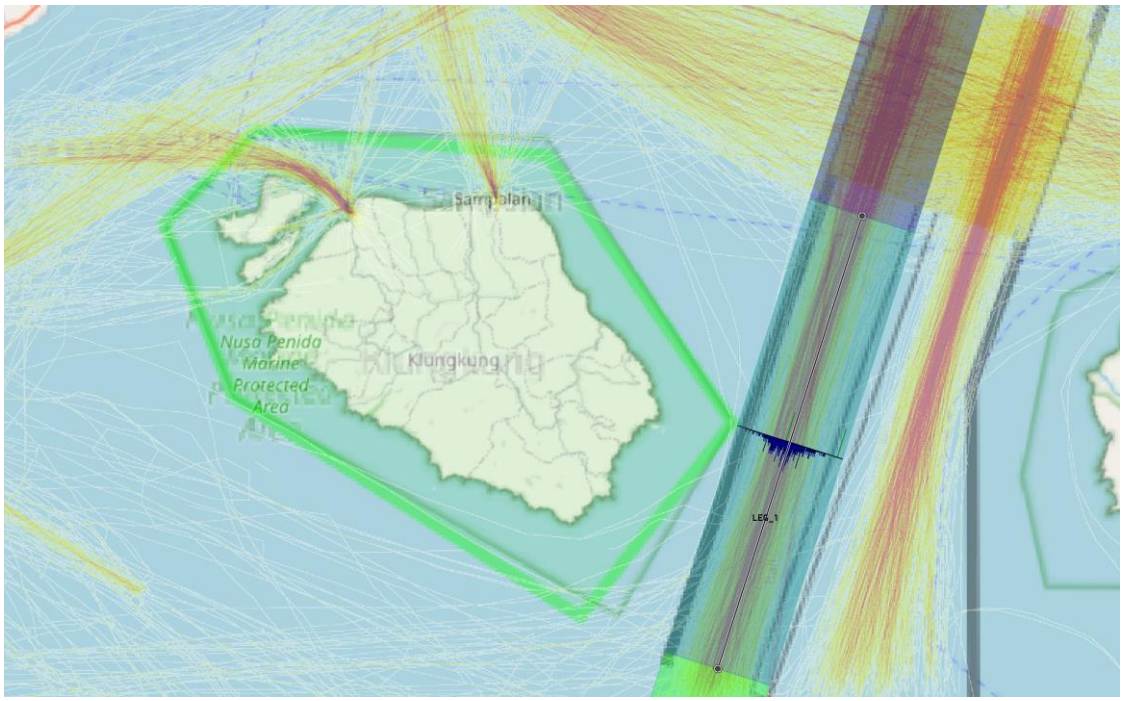


Figure 4: Traffic distribution in Lombok Strait follows the normal distribution

1.10 It is expected that the shipping activity in the vicinity of Lombok Strait will increase due to the growth of the traffic at the Straits of Malacca and Singapore and Sunda Strait and the economic development in East Asia. The traffic is also affected by the increasing number of yacht and cruise vessels which are expected to increase due to the adoption of Indonesian Presidential Decree Number 105 Year 2015 on Foreign Yacht Visits to Indonesia, and the Minister for Transportation Regulation Number PM 121 Year 2015 on Facilitation for Tourist Visits by Foreign Cruise Ship. Both regulations ease the requirements and facilitate better access of yacht and cruise vessels in the tourist destinations.

1.11 The increasing traffic also occurred in two main shipping routes which intersect in the middle of Lombok Strait. An international shipping route which lies on the north–south bound intersects with a national shipping route which lies on the east–west bound of Lombok Strait. The international shipping route traffic is increased since there is greater transportation of commodities between South-East and East Asia countries to Australia. Likewise, the national shipping route traffic is increasing due to the increased crossing traffic along shipping routes between Padang Bai, Sanur, Amed, Nusa Lembongan and Senggigi, Teluk Nare, Bangsal, and Gili Islands. Ship traffic density between these routes would be likely to be growing since the Indonesian Government are accelerating development especially for the eastern part of Indonesia including this area.

1.12 After the implementation of the TSS in the Lombok Strait, particularly in the IASL-II, a notable decrease in collision frequency has been observed. The introduction of designated lanes for maritime traffic has significantly enhanced navigational safety in this crucial maritime passage. By segregating inbound and outbound vessels, the TSS has reduced the risk of collisions and improved overall traffic management. The IALA Waterway Risk Assessment Program (IWRAP) is used and shows that the TSS Lombok Strait reduced the total frequency of ship collisions by 60.3%. AIS data from 2017 is used as the benchmark for calculating the collision frequency before the implementation of TSS and it is found to be 0.461 accident per year (Dinariyana et al., 2020). While the AIS data from 2023 is used to compare the calculation after the TSS implementation and the frequency becomes 0.0002634 accident per year.

Harmful substances carried

1.13 The heightened traffic of tankers within the IASL-II, particularly near Nusa Penida Island, increases the probability of ship grounding and drifting incidents in the region. Tankers, carrying large volumes of dangerous liquid cargo, face heightened risks of grounding due to factors such as strong currents, unpredictable weather conditions and the intricate geography of the area. The hazard of an oil spill could possibly take place due to grounding or drifting of those tankers. The number of chemical and oil tankers that navigated in the IASL-II in 2023 is recorded as high as 8,791 unique trips, which is 11% of the total traffic in the Lombok Strait. However, the TSS Lombok Strait as well as the Lombok Reporting System (LOMBOKREP) have reduced the collision frequency by separating the traffic as well as improving the voluntary ship reporting.

2 Natural factors

Hydrographical

2.1 The Lombok Strait is around 30 km wide in the northern and central parts. On the southern side of the Lombok Strait, which is the exit to the Indian Ocean, the width is narrowed to around 18 km due to the presence of Nusa Penida Island, the deepest part of which is only around 250 metres. With this depth, it can be said that this strait is deeper than the Malacca Strait which only has a water depth of 200 metres, so that the Lombok Strait is more suitable for large ships to pass through (Anwar, 2021).

2.2 The southern seabed bathymetry of Nusa Penida, which starts from Tanjung Bakung to Tanjung Sari is very steep at a depth of 20 m but beyond this depth of 20 m, the steepness of the seabed decreases, up to a depth of 500 m where the slope reaches a 4.2% gradient. The eastern sea waters of Nusa Penida from Tanjung Kerambitan to Batu Abah are also quite steep. The steepness of the seabed is high, especially at depths of 0-50 m (Department of Marine Affairs and Fisheries Denpasar, 2017).

Meteorological

2.3 The waters of eastern Indonesia, especially in the Lombok Strait, and the characteristics of currents south of Java are influenced by the annual cycle of monsoon winds. Lombok's waters are influenced by the east monsoon, which occurs in June, July and August with high air pressure over mainland Australia and low-pressure centres over mainland Asia. This causes the wind to move from east to west. Monsoons affect seawater circulation and climatology such as wind, rainfall and others. In equatorial areas, during the east monsoon, rainfall is very low, affecting salinity levels and the abundance of phytoplankton. Rainfall in eastern Indonesia is relatively low, less than 1.5 m/year. Rainfall is highest in Bali and Lombok from December to February, with rainfall of more than 1500 mm/year in 2023. Ships passing through the Lombok Strait must be alert due to navigational errors that could lead to accidents.

Oceanographic

2.4 Internal waves can be seen in the Lombok Strait as one of the outflow straits from ITF which flows water from the Pacific Ocean to the Indian Ocean. Due to the presence of multi-layered waters, rough topography and strong tidal currents, the Lombok Strait has the characteristics of intense internal waves. The wave speed between the islands of Lombok and Nusa Penida is 1.8-1.9 m/s (Susanto et al., 2005).

2.5 The Lombok Strait is one of the straits in Indonesian waters that has internal solitary waves with high amplitude. Waves are generated by stratified waters through the interaction between strong tidal currents, background currents (such as the Indonesian Throughflow), and rough bottom topography. Analysis of two consecutive satellite SAR images obtained on 23 and 24 April 1996 showed that internal waves were generated by the interaction of successive semidiurnal tidal currents with the southern sill of the Lombok Strait. The average propagation speed is 1.96 m/s (Susanto et al., 2005).

3 Other information

3.1 Several ship accidents have occurred in the Lombok Strait. Based on data from the National Transportation Safety Committee, there were at least seven accidents reported from 2006 to 2023. The most common type of accident was fire. Fires involving tankers occurred in 2014, 2017 and most recently in 2023, with a fire on the deck of the oil tanker **MT Christine**. Oil tanker fires could cause an oil spill that could damage the marine environment in the Lombok Strait. To mitigate the impact of the fire on the **MT Christine**, an oil boom was installed to prevent oil from spilling into the waters of the Lombok Strait. A ship fire involving a ro-ro passenger ferry also occurred in 2022. The location of the ship fire was in the waters north-east of Bali, near the TSS Lombok Strait and the ship drifted towards the TSS Lombok Strait.

3.2 If there is a maritime incident near Lombok Strait, the port authority in Padang Bai and Lembar has patrol boats available. It would take around three hours for a patrol boat to reach the precautionary area in TSS Lombok Strait.

3.3 Based on AIS data in January 2023, there were several ship trajectories in south-west bound traffic that were crossing the TSS line. It was also found that a vessel entered and immediately left the Nusa Penida MPA zone (see figure 5).

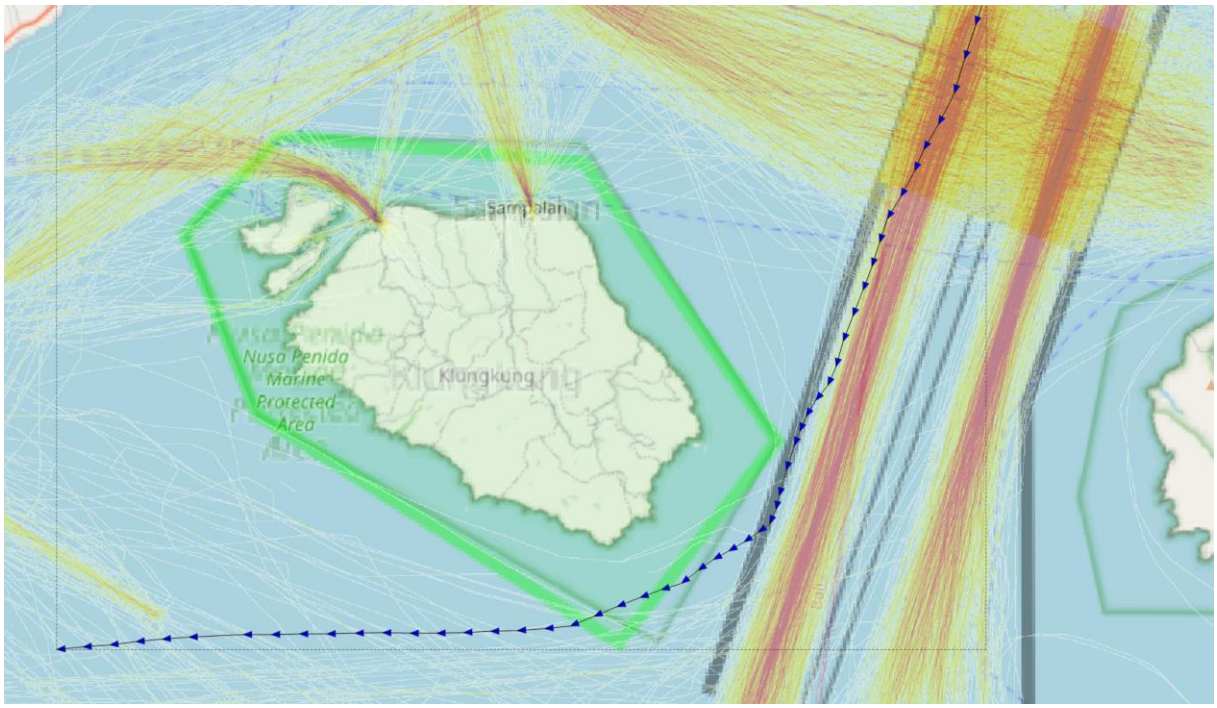


Figure 5: An oil products tanker, found inside the MPA area but outside the core zone

3.4 Oil spill simulations conducted for ship collision in Lombok Strait have been performed. The oil spill dispersion scenario is carried out by assuming that a collision involving a tanker and general cargo occurs in the crossing area between ships passing on IASL-II and ships crossing IASL-II from the Padang Bai side in Bali to the Lembar in Lombok. It is assumed that the point of occurrence of crossing collision is 8° 38' 91" S and 115° 44' 02" E. This scenario is based on the results of collision frequency calculations in IWRAP which show that the largest frequency values occur on the two types of ships. The tanker used in the simulation has a length of 261 m with a capacity of 150,000 dwt. The same data used by van de Wiel and van Dorp in 2011 is utilized. Based on their study, one tank with a volume of 14,561 m^3 is estimated to spill in the amount of 11,970 m^3. There are two conditions in the direction of the wind and sea current that are used, towards north-west and south-west. When the wind direction is north-westward, after 12 hours of simulation, spilled oil does not reach the MPA of Nusa Penida. After 12 hours, there was about 86.4% of the oil floating on the surface of the seawater, and 13.6% had dispersed into the air. Within 12 hours, the 86.4% oil that floated did not reach the shoreline. When wind and sea current were heading to the southwest from the point of impact, after 8 hours, the oil spill did reach to MPA of Nusa Penida. After 12 hours of simulation, there was about 70.6% of oil floating above the water surface, 15.9% of the spill would reach the MPA and 13.6% were dispersed into the air. Based on the results of the simulation, the response from the authorities in dealing with the spread needs to be done on the condition if a collision occurs in the crossing area while the wind and sea current are heading south-west (Dinariyana et al., 2020).

ANNEX 4

ASSOCIATED PROTECTIVE MEASURES FOR THE NUSA PENIDA ISLANDS AND GILI MATRA ISLANDS IN LOMBOK STRAIT PSSA

Associated protective measures (APMs)

The newly established routeing systems (traffic separation scheme (TSS)) at the Lombok Strait are the APMs, as follows:

.1 3.0 NM wide TSS separated by 0.3 NM separation zone in Lombok Strait as a main shipping lane for national and international route at the northern entrance of Lombok Strait. The total length of the TSS is approximately 4.9 NM, which lies between northern bound and proposed northern precautionary area;

.2 a northern precautionary area with recommended directions of traffic flow that lies on the proposed northern TSS. The length of the northern precautionary area is approximately 4.62 NM to the south;

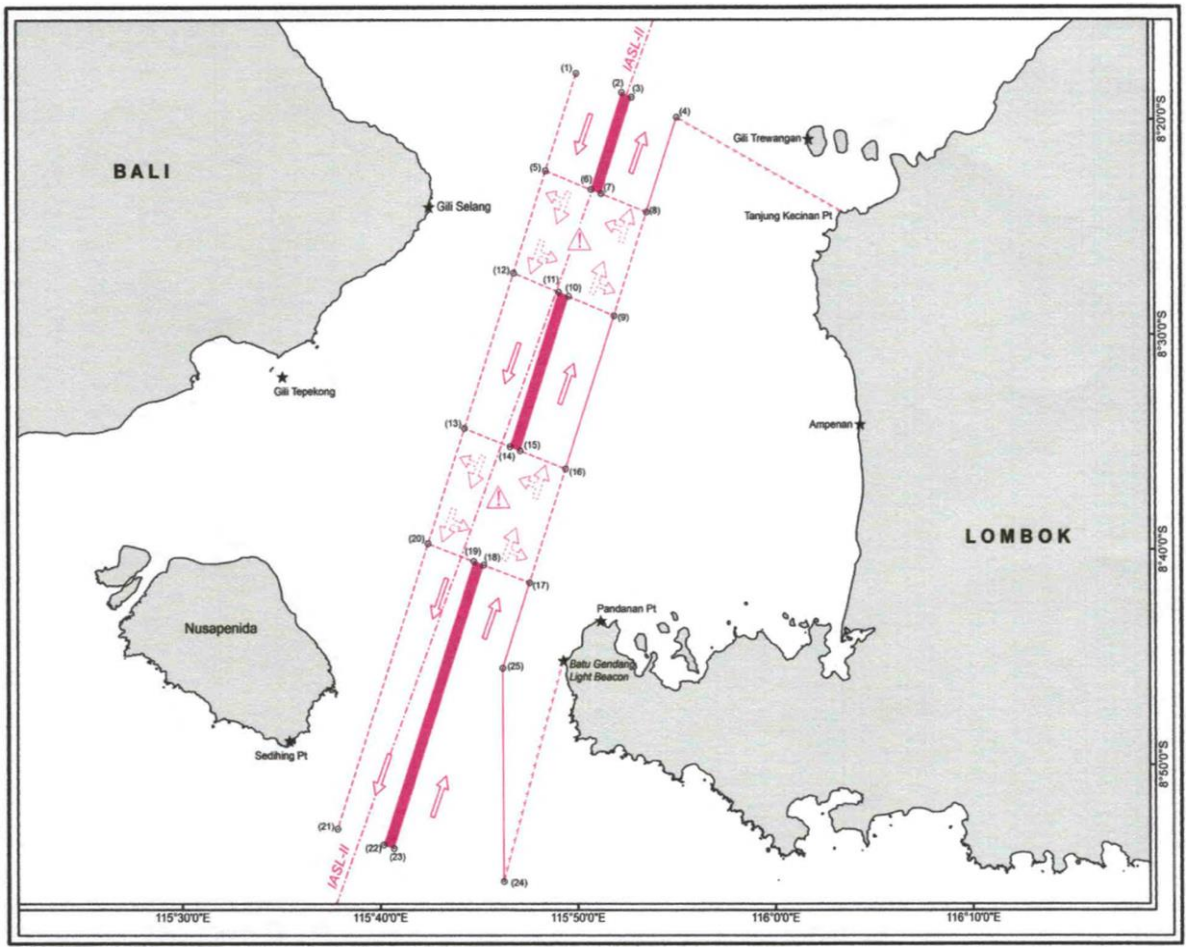
.3 3.0 NM wide TSS separated by 0.3 NM separation zone that lies between northern precautionary area and southern precautionary area. The total length of the proposed TSS is 8.2 NM;

.4 a southern precautionary area with recommended directions of traffic flow that lies on the proposed southern TSS with the length approximately 4.62 NM;

.5 3.0 NM wide TSS separated by 0,3 NM separation zone in the Lombok Strait as a main shipping lane at the southern entrance of the Lombok Strait. The total length of the proposed southern TSS is approximately 13.9 NM; and

.6 inshore traffic zone that lies from TSS to Lombok Island and Gili Trawangan Island.

(**Note**: These routeing systems were approved at the sixth session of the Sub-Committee on Navigation, Communications and Search and Rescue (NCSR 6/3/4), subsequently adopted by MSC 101 and entered into force on 1 July 2020. The establishment of the TSS in Lombok Strait is in COLREG.2/Circ.74 dated 14 June 2019 and the SN.1/Circ. 337 dated 14 June 2019.)



Charlet 1: Chart of the traffic separation scheme in Lombok Strait, approved by MSC 101.

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