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Marine Protected Area in Southeast Asia: A Brief Look into the Current Landscape, Key Benefits, and Challenges

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WORKING PAPER

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Marine Protected Area in Southeast Asia: A Brief Look into the Current Landscape, Key Benefits, and Challenges

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Abstract

This paper provides a brief overview on the current landscape of marine protected areas (MPAs) in Southeast Asia (SEA). SEA is one of the most biodiverse regions in the world: with just 2.5% of the global marine surface area, the region harbours more than 30% of coral reefs, 50% of seagrass species, and possesses the highest diversity of coral reef fish. However, as a global repository of marine biodiversity and endemism, this region has also been rated as one of the most biotically threatened. To address the losses in marine biodiversity and habitats, MPAs have been increasingly adopted worldwide, including in the SEA. Nonetheless, there exist several problems in the implementation of MPAs in the region. For one, the growth of MPAs in the SEA has been moderately slow compared to other regions. In addition, the question arises as to whether the MPAs in the region are effectively addressing biodiversity needs or are mere "paper parks" piously declared but achieved minimal results in reality. To investigate this issue, the paper highlights issues affecting MPAs' success, including the lack of management effectiveness, law enforcement, and financial capacity. In addition, the relationship with local communities in SEA's MPAs is a pertinent issue, as locals play important roles in enabling the biological and socio-economic success of MPAs.

Keywords*:* Southeast Asia, marine protected area, area-based conservation measures, biodiversity, marine ecosystems

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Table of Contents

1. Marine Ecosystem in Southeast Asia

1.1 Background

The Southeast Asia (SEA) region is blessed with rich and abundant marine resources (Southeast Asian Fisheries Development Centre, 2022). Made up of 11 sovereign states – Brunei, Cambodia, Timor-Leste, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, and Vietnam, the surface area of all seas in the region amounts to over 9 million km^2, representing just 2.5% of global ocean surface area (Chou, 2014) (Table 1 and Figure 1 provide the marine surface areas of SEA countries). With a marginal surface area, SEA harbors more than 30% of the world's coral reefs, almost 50% of existing seagrass species, as well as 600 of the 800 reef-building coral species, housing the highest levels of marine biodiversity on earth (Burke et al., 2002; Savage et al., 2020).

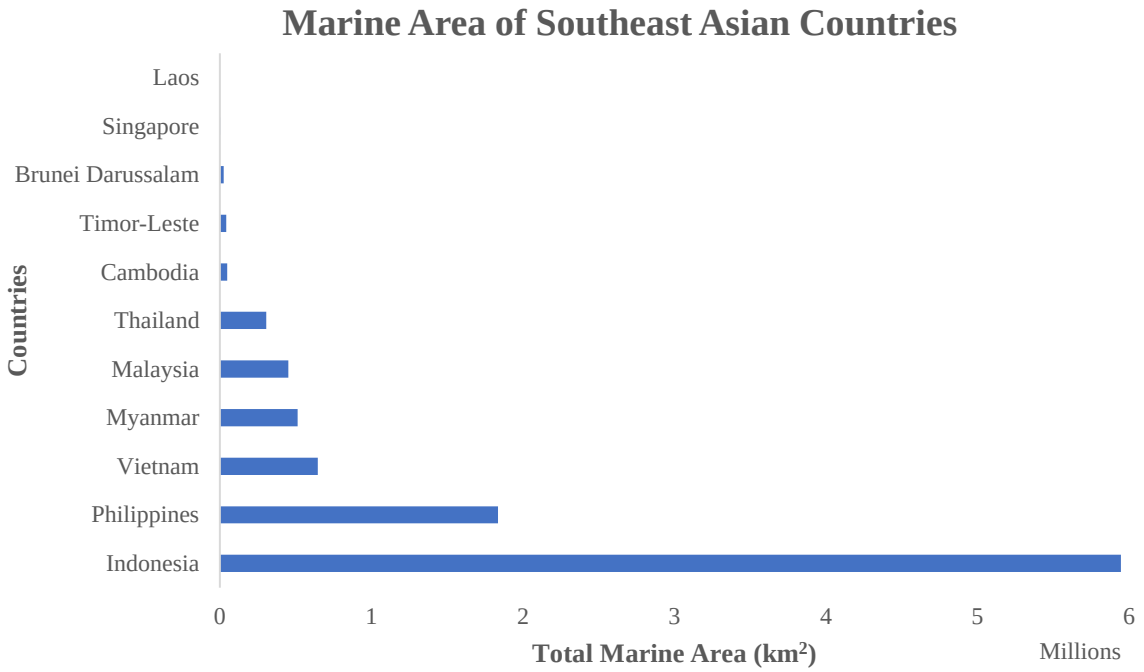
Table 1. *Marine Area of Countries in Southeast Asia*

Countries	Total Marine Area (km2)
Laos	0
Singapore	763
Brunei	25,698
Timor-Leste	42,501
Cambodia	47,967
Thailand	306,891
Malaysia	451,742
Myanmar	514,147
Vietnam	647,232
Philippines	1,835,028
Indonesia	5,947,954

Source: Protected Planet (2022)

Figure 1.

Marine Area (km^2) of Countries in Southeast Asia



Source: Protected Planet (2022)

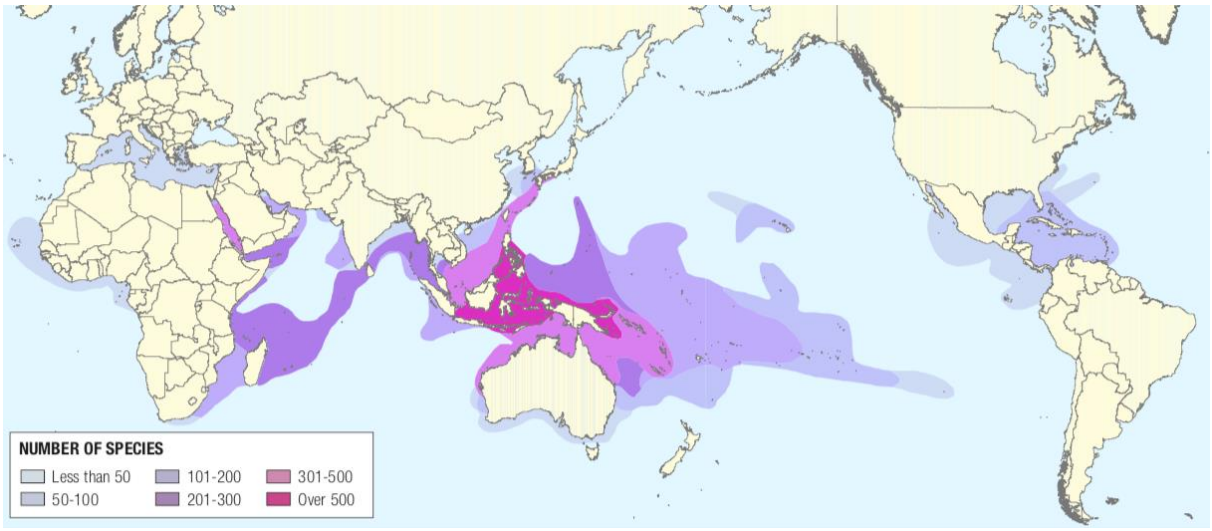
The geographic location of the SEA region is an important factor contributing to its role as a global marine biodiversity hotspot (Chou, 2014; Kamil et al., 2017). The world's two largest archipelagos, Indonesia and the Philippines, consist of more than 25,000 islands (Chou, 2014). Almost all SEA countries along the Asian continent comprise vast coastlines and various offshore islands, most of which are either volcanic or coral. The coastlines amount to approximately 92,450km, which is around 16% of the world's total coastline (Chou, 2014). Coastlines support a wide variety of coastal features, such as cliffs, coves, beaches, deltas, spits, and dunes, all of which harbor high species richness. Furthermore, the scattering locations of islands in the region facilitate the transfer of nutrient content by shifting terrestrial inputs to the marine system (Chou, 2014). The warm and humid weather year-round also contributes to the formation of distinctive natural assets (Chou, 2014; Kamil et al., 2017).

For instance, the SEA region is well known for its abundant coral reefs (Cheung et al., 2002). In particular, the region harbors approximately 34% of the world's coral reefs, which span a total of 100,000km^2, and is nominated globally as a region with the highest diversity of reef-associated fauna (Kamil et al., 2017; Savage et al., 2020). Coral reefs are animals that, in the simplest form, contain a single polyp with a tube-like body and a ring of tentacles at the top section (Burke et al., 2002). In many coral species, the single polyp forms numerous clones in condensed formations, called colonies (Burke et al., 2002). In addition to reducing the wave impacts on coasts by up to 97%, coral reefs act as a vital ecosystem for marine life (Natural History Museum, n.d.). According to the National Ocean Service (n.d.) by the United States Department of Commerce, coral reefs support most species per unit area among all marine environments. For instance, approximately one-fourth of all marine life (i.e., 4,000 fish species) are dependent on them at some point in their lifecycle (National Ocean Service, n.d.; United States Environmental Protection Agency, 2021). This is because the coral reef ecosystem provides crucial feeding, spawning, and nursery grounds for aquatic species (United States Environmental Protection Agency, 2021). In addition, coral reefs are extremely valuable as they are considered key to the creation of new medicines for numerous diseases, such as cancer, arthritis, and infections. Moreover, coral reefs are an important source of revenue for businesses through recreation and tourism activities (National Ocean Service, n.d.).

Figure 2 illustrates the high concentration of reef-building Scleractinian coral species in the region. In particular, the Scleractinian coral species are concentrated in the broad Indo-Malaysian Triangle area, which extends from the Philippines to southern Indonesia and encompasses all of East Java to New Guinea (Burke et al., 2002). Specifically, the SEA region contains over 600 of 800 Scleractinia found worldwide (Burke et al., 2002).

Figure 2.

Diversity Patterns of Reef-Building Scleractinian Corals



Source: From Burke. L., Reytar, K., Spalding, M., & Perry, A. (2011). *Reefs at risk revisited*. Copyroght 2011 by Burke.

Importantly, the marine waters enclosing Indonesia, Malaysia, and the Philippines fall within the Coral Triangle Region (CTR) (Kamil et al., 2017). Regarded as "one of the most important reef systems in the world", the CTR occupies only 1.5% of the global ocean area but constitutes 30% of global coral reefs (Gray, 2018, para. 1). It possesses the greatest coral diversity in the world, accounting for more than three-fourths of the world's known coral species (Coral Triangle Atlas, n.d.; Gray, 2018). Of the different coral species, 15 are endemic to the region (Gray, 2018). In comparison, the Caribbean, which is also famous for its coral reef ecosystem, consists of only 8% of coral species (Coral Triangle Atlas, n.d.).

As the global epicenter for coral reefs, both in terms of coverage and species diversity, it is not surprising that the CTR harbors the highest diversity of coral reef fish (Coral Triangle Atlas, n.d.). Coral reef fish are fish species that reside among or in close relation to coral reefs. Among the consensus of 5,000 to 8,000 coral fish species worldwide, the CTR is home to approximately 2230 species types (i.e., between 28% to 45%) (Coral Triangle Atlas, n.d.;

Victor, 2015). In comparison, the Hawaiian Islands have only 420 species (i.e., 5% to 8.5%) (Coral Triangle Atlas, n.d).

The mangrove forest is another marine-related ecosystem that possesses great ecological and economic importance (Burke et al., 2002; Carugati et al., 2018). In essence, mangroves are salt-tolerant plants that grow in intertidal areas of sheltered coasts around estuaries and lagoons (The Fish Site, 2009). Due to their unique – part marine, part terrestrial – composition and environment, they play vital roles in providing food, breeding grounds, as well as nurseries for terrestrial and marine biodiversity, including many commercial and juvenile reef species (Carugati et al., 2018). For instance, according to the American Museum of Natural History (n.d.), it is estimated that 75% of commercial fish either seek shelter in mangroves or are reliant on food webs linked to these coastal forests. Besides commercially-caught fish, mangroves also act as nursery sites for fish species listed on the IUCN Red List of Threatened Species, such as the "near threatened" rainbow parrotfish and "critically endangered" overexploited goliath grouper (IUCN, 2017). In addition, mangrove forests are also important sources of livelihood – for instance, an estimated 80% of small-scale fishers in many countries rely on mangrove ecosystems to support their operations (Global Mangrove Alliance, 2021). In particular, they house many commercial seafood, such as crabs, shellfish, and oysters, to sea cucumbers, sea urchins, snails, and fish, which are permanent residents that can be directly harvested from within (IUCN, 2017).

Mangroves are distributed in more than 120 countries around the globe (Gandhi & Jones, 2019). While the global estimates of mangrove coverage vary, it is generally agreed that SEA represents one-third of the global mangrove forest, with Indonesia alone housing 20% of them (see Table 2 for the mangrove coverage in the respective SEA countries) (Burke et al., 2002; Global Mangrove Alliance, 2021; The Fish Site, 2009; Richards & Friess, 2016). Five

of the top 11 countries with the most mangroves are in the SEA: Indonesia, Malaysia, the Philippines, Thailand, and Vietnam (ASEAN Focus, 2021). In addition, the SEA is home to the greatest diversity of mangrove species – according to Gandhi and Jones (2019), it has 51 of the 73 known species, which is almost 70% (Burke et al., 2002; Richards & Friess, 2016). Moreover, the tropical weather in SEA enables mangrove forests to attain maximal luxuriance and development. According to a systematic review, mangrove forests in the region revealed the highest mangrove ecosystem productivity (Singh et al., 1994, as cited in Chou, 2014). This result was obtained by measuring different production parameters, such as phytoplankton production, benthic primary production, and total litter production.

Table 2. *Mangrove Habitat Extent Area of Southeast Asian Countries in 2016*

Countries	Area of mangrove habitat extent (2016)	
	km^2	ha
Singapore	5	522
Timor-Leste	9	933
Brunei	106	10,628
Cambodia	586	58,560
Vietnam	1,578	157,849
Thailand	2,247	224,687
Philippines	2,675	267,527
Myanmar	4,953	495,345
Malaysia	5,098	509,809
Indonesia	26,508	2,650,812
Total	43,767	4,376,672

Note. Square kilometers are rounded up to the closest whole number. Hectares are calculated by multiplying the respective square kilometers by 100.

Laos is excluded from the analysis due to its landlocked status.

Source: Global Mangrove Watch (2016)

1.2 Degradation of Marine Area and Habitat

Since the mid-1960s, marine ecosystems in the SEA have undergone serious degradation (Chou, 2014). This is due to rapid industrialization, strong economic development, and burgeoning human populations in the region (Chou, 2014). In particular, these factors have caused heavy anthropogenic pressure on the environment, bringing serious ramifications to the marine ecosystems in the region (Chou, 2014). The impacts of human activities on the coastal and marine ecosystem in SEA are especially relevant, given that 85% of SEA's population resides within 100km of the coasts, while the global coastal population averages at 40% (Chou, 2014).

Development activities such as harbor dredging and land reclamation directly affect coral health by damaging reef substrate and increasing sedimentation (Burke et al., 2002). For instance, Singapore has lost approximately 60% of its coral reefs because of land reclamation (Tay et al., 2018). Among six regions (i.e., Atlantic, Australia, Indian Ocean, Middle East, Pacific, and the SEA), local threats to coral reefs are the most prominent in the SEA, where nearly 95% of coral reefs are threatened, with almost half in the high and very high threat categories (Burke et al., 2011) (see Table 6). This percentage is calculated using an index that comprises four components: (i) overfishing and destructive fishing, (ii) marine-based pollution and damage, (iii) coastal development, and (iv) watershed-based pollution.

Table 3. *Integrated Threat to Coral Reefs by Regions*

Region	Coastal population within 30km of the reef (millions)	Integrated local threats (%)			
		Low	Medium	High	Very high
Australia[a]	3,509	86	13	1	<1
Pacific	7,487	52	28	15	5
Middle East	19,041	35	44	13	8
Atlantic	42,541	25	44	18	13
Indian Ocean	65,152	34	32	21	13
SEA	138,156	6	47	28	20

Notes. a. The Australia region includes the Australia territories of Christmas Island and Cocos/Keeling Islands.
Source: Burke et al. (2011)

Another coastal development that seriously impacts the marine ecosystem is mangrove deforestation. Deforestation of mangrove forests has been carried out to support the needs of growing populations (Global Mangrove Alliance, 2021). In the SEA, mangrove forests have been largely converted into aquaculture ponds to carry out rice production, oil palm plantation, fishing, shrimp farming, as well as urban areas and settlements. Another cause of mangrove deforestation involves "non-productive conversion", a phenomenon that occurs when mangrove areas become unused lands (Global Mangrove Alliance, 2021). These include direct impacts from clearance (i.e., which is primarily done to obtain charcoal and timber), as well as indirect losses through alterations in water distribution, movement, and quality (i.e., including effects of pollution from oil, gas extraction, and nutrient runoffs). Table 4 illustrates the percentages of mangrove conversion to different usages between 2000 to 2012. In particular, aquaculture constitutes the primary usage of mangrove conversion in SEA. The next most popular usage is oil palm plantation, especially in Malaysia, Thailand, and Brunei.

Table 4. *Conversion of Deforested Mangroves to Distinct Land Uses between 2000 and 2012*

	Land Uses (%)					
	Aquaculture	Rice	Oil palm	Mangrove regrowth	Urban	Others
Brunei	29.2	0	27.7	12.5	15.9	14.8
Cambodia	27.7	1.5	8.9	9.8	4.6	47.6
Indonesia	48.6	0.1	15.7	22.6	1.9	11.2
Malaysia	14.7	0.1	38.2	17.6	12.8	16.7
Myanmar	1.6	87.6	1.1	0.5	1.6	7.6
Philippines	36.7	0.9	11.1	7.3	2.7	41.3
Singapore	0	0	0	0	0	0
Thailand	10.8	5.6	40.0	5.1	14.4	24.1
Timor-Leste	0	26.1	0	0	0	73.9[a]
Vietnam	21	10.4	0.5	0.6	62.5	4.9
Total	29.9	21.7	16.3	15.4	4.2	12.3

Note. a: The small amount of mangrove conversion in Timor-Leste is due mainly to shoreline erosion.
Source: Richards & Friess (2016)

Mangrove deforestation hotspots have been identified in Myanmar (esp. in the Rakhine state), Indonesia Sumatra, and Malaysia. On the contrary, mangrove deforestation rates are markedly lower in Thailand, Vietnam, and the Philippines (Richards & Friess, 2016). Despite the varying rates of mangrove deforestation across the region, the latest data has revealed the second-highest mangrove net losses in SEA at 6%, closely tailing the highest net loss in North and Central America and the Caribbean at 7% (Global Mangrove Alliance, 2021) (see Table 5 for the area of mangrove extent in selected regions).

Table 5. *Area of Mangrove in Selected Years from 1996 to 2016*

	Mangrove area (km^2)						
Region	1996	2007	2008	2009	2010	2015	2016
East Asia	170	169	167	165	164	170	171
Middle East	330	321	324	325	324	315	315
Pacific Islands	6,368	6,325	6,326	6,326	6,333	6,278	6,285
East & Southern Africa	7,577	7,317	7,341	7,332	7,311	7,271	7,276
South Asia	8,625	8,497	8,493	8,483	8,495	8,404	8,414
Australia & New Zealand	10,278	10,172	10,186	10,187	10,201	9,980	9,983
South America	19,512	19,105	19,146	19,145	19,127	18,907	18,943
West & Central Africa	20,016	19,913	19,933	19,930	19,916	19,807	19,767
North & Central America & the Caribbean	22,591	21,888	21,986	21,849	20,875	21,205	20,962
Southeast Asia	46,491	44,355	44,378	44,314	44,051	43,587	43,767
Total	141,957	138,064	138,279	138,054	136,798	135,925	135,882

Source: Global Mangrove Alliance (2021)

Deforestation of mangrove forests resulted in the declining population of valuable mangroves species. Examples include the *Sonneratia griffithii* and *Bruguiera hainesii*, both of which are rated as "critically endangered" on the IUCN Red List (Polidoro et al., 2010). Scattered in parts of India and SEA, a combined 80% loss of *Sonneratia griffithii* has taken place in the latter region. In the SEA, deforestation of *Sonneratia griffithii* is especially prominent in Malaysia due to mangrove clearing for aquaculture and rice farming (Polidoro et al., 2010). *Bruguiera hainesii* is an even rarer species: it is considered the rarest mangrove species to date and could only be found in several scattered locations across Indonesia, Malaysia, Thailand, Myanmar, and Singapore (Ono et al., 2016; Polidoro et al., 2010). There are approximately fewer than 250 mature individuals left, which propagations are further complicated by the species' low germination rate (Polidoro et al., 2010).

Another major threat to SEA's marine ecosystem is overfishing (Burke et al., 2002, 2011; Cheung et al., 2002; Deridder & Nindang, 2018; The ASEAN Post, 2018; The Hornet Newspaper, 2020). Overfishing occurs when the removal of marine species happens at a rate higher than the natural breeding cycles, which may eventually lead to species depletion. The marine industry plays a critical role in the SEA's economy, as it accounts for over 20% of global marine capture production (Southeast Asian fisheries Development Center, 2022) (see Table 6 and Figure 3 for marine capture production by continent, Table 7 and Figure 4 for fisheries production of respective SEA countries in 2019).

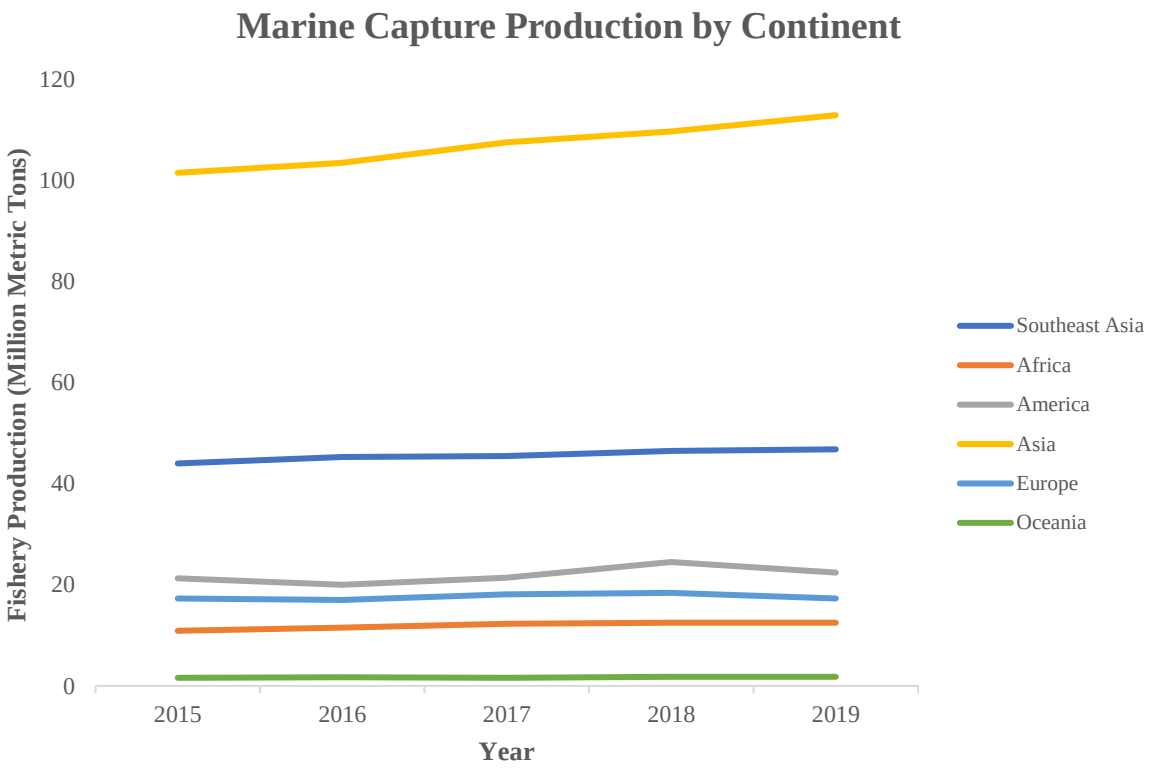
Table 6. *Total Marine Capture Production by Continent from 2015 to 2019*

	Fishery production in million metric tons (M.MT) and percentage (%)									
	2015		2016		2017		2018		2019	
	M.MT	%	M.MT	%	M.MT	%	M.MT	%	M.MT	%
SEA	44	22.4	45.3	22.8	45.5	22.0	46.5	21.8	46.8	21.9
Africa	10.9	5.5	11.5	5.8	12.3	6.0	12.5	5.9	12.5	5.8
America	21.3	10.8	20	10.1	21.4	10.4	24.5	11.5	22.4	10.5
Asia[a]	101.5	51.6	103.5	52.0	107.5	52.1	109.7	51.4	112.9	52.8
Europe	17.3	8.8	17	8.5	18.1	8.8	18.4	8.6	17.3	8.1
Oceania	1.6	0.8	1.7	0.9	1.6	0.8	1.8	0.8	1.8	0.8
World	196.6	100.0	199	100.0	206.4	100.0	213.4	100.0	213.7	100.0

Note. a. Excludes Southeast Asia
Source: Southeast Asian Fisheries Development Center (2022)

Figure 3.

Marine Capture Production by Continent from 2015 to 2019



Source: Southeast Asian Fisheries Development Center (2022)

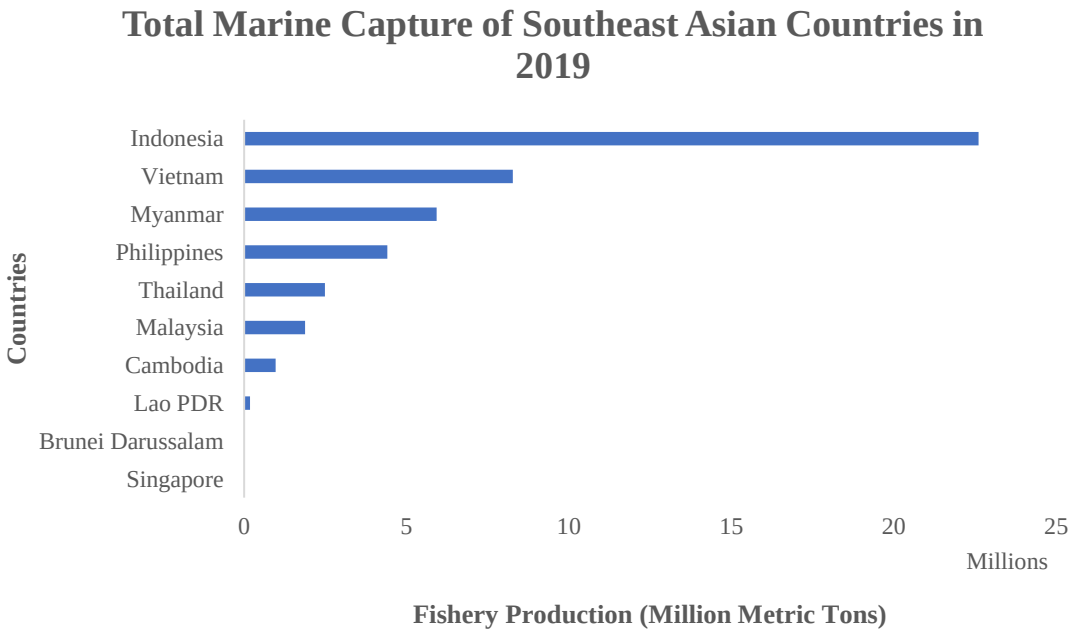
Table 7. *Breakdown of Southeast Asian Countries' Marine Production in 2019*

	Marine production in metric tons (MT)			
	Marine capture	Inland capture	Aquaculture	Total
Singapore	1,418	-	5,831	7,249
Brunei	13,725	N/A	933	14,658
Laos	-	70,900	113,000	183,900
Cambodia	137,225	524,465	307,408	969,098
Malaysia	1,455,446	5,569	411,782	1,872,797
Thailand	1,410,665	116,465	961,703	2,488,833
Philippines	1,900,210	154,681	2,358,238	4,413,129
Myanmar	3,249,700	1,600,050	1,082,065	5,931,815
Vietnam	3,583,000	194,700	4,492,500	8,270,200
Indonesia	6,416,150	649,978	15,548,467	22,614,595
Total	18,167,539	3,316,808	25,281,927	46,766,274

Notes. a. Marine capture refers to all commercial and small-scale fisheries, inland capture refers to any activity that involves catching or collecting aquatic organisms from freshwater areas, aquaculture refers to the farming of aquatic organisms in mariculture, brackishwater culture, and freshwater culture.
b. Brunei's inland capture figure is not available, while Singapore does not have inland capture.
c. Laos does not have marine capture.
Source: Southeast Asian Fisheries Development Center (2022)

Figure 4.

Southeast Asian Countries' Total Marine Capture Production in 2019



Source: Southeast Asian Fisheries Development Center (2022)

In addition, fish and seafood are the primary sources of animal protein in the region (Cheung et al., 2002; Deridder & Nindang, 2018). In particular, marine capture accounts for 60% to 70% of animal protein intake among people in the Philippines, Indonesia, and Malaysia, highlighting the importance of fishery activities as a critical source of sustenance (Cheung et al., 2002; Deridder & Nindang, 2018). Overall, 64% of fishery resources in the SEA are at a medium to high risk of being overfished, with Cambodia and the Philippines being the most significantly impacted (Deridder & Nindang, 2018).

Furthermore, studies estimated that the amount of trash fish captured (i) exceeds 60% of South China Sea's total marine production, comprises (ii) approximately 60% of total capture in the Gulf of Thailand, (iii) 30% to 80% of total fish capture in Vietnam, and (iv) 50% of trawl catches from western Malaysia (United Nations, 2004). While there are varying definitions of trash fish, it is generally referring to fish that are either juveniles, have low consumer preference, or have little to no commercial values (FAO, n.d., a). In some instances, these trash fish are directly consumed in households to avoid wastage, especially in countries such as Bangladesh (FAO, n.d., a; World Wide Fund for Nature, 2022). However, a large proportion of these fish are discarded overboard in conditions of either dying or dead (FAO, n.d., a; World Wide Fund for Nature, 2022). Besides incurring wastage, the high rates of trash fish capture can affect the sustainability of the marine ecosystem in the long run (FAO, n.d., b). This is because juvenile fish are harvested before carrying out species reproduction (FAO, n.d., b).

The degradation of vital marine ecosystems results in enormous losses in economic benefits. For instance, projections have estimated an annual diminution of US$2.2 million from mangrove loss and US$5.6 billion from coral reef loss in 2050 (ASEAN Focus, 2021). To address the degradation of marine ecosystems, recent decades have seen an increase in active

management plans. One of the main measures used to protect marine areas is the establishment of MPAs (Burke et al., 2002; Our Shared Seas, 2022).

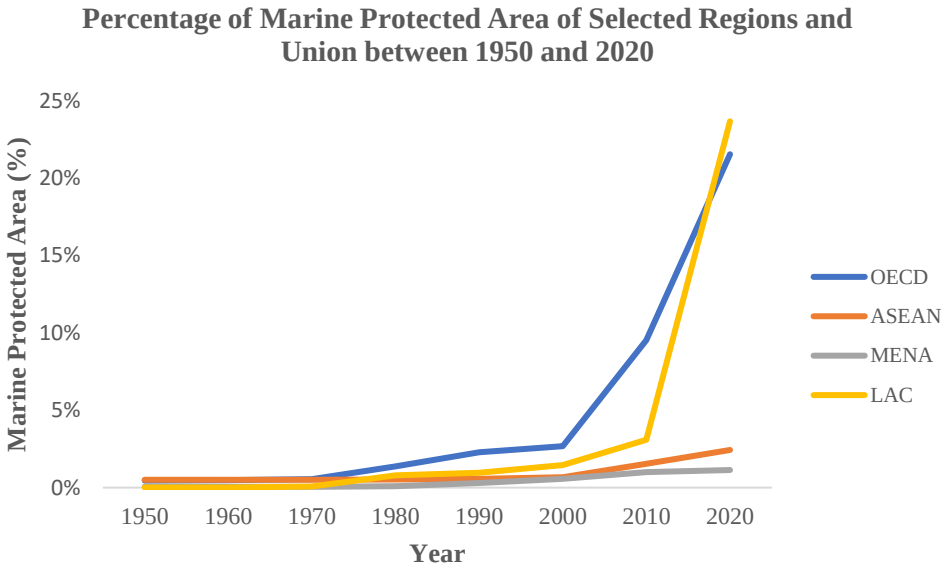
2. Marine Protected Area in Southeast Asia

2.1 Background

Area-based conservation measures offer key perspectives to achieving the post-2020 global biodiversity and sustainability goals (Hoffmann, 2021). Specifically, area-based conservation consists of protected area (PA) and other effective area-based conservation measures (OECM). According to the International Union for Conservation of Nature (IUCN) (2022a), a PA can be defined as "*a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values*" (para. 1).

Figure 5.

The trend of Marine Protected Area Coverage of Selected Regions and Union



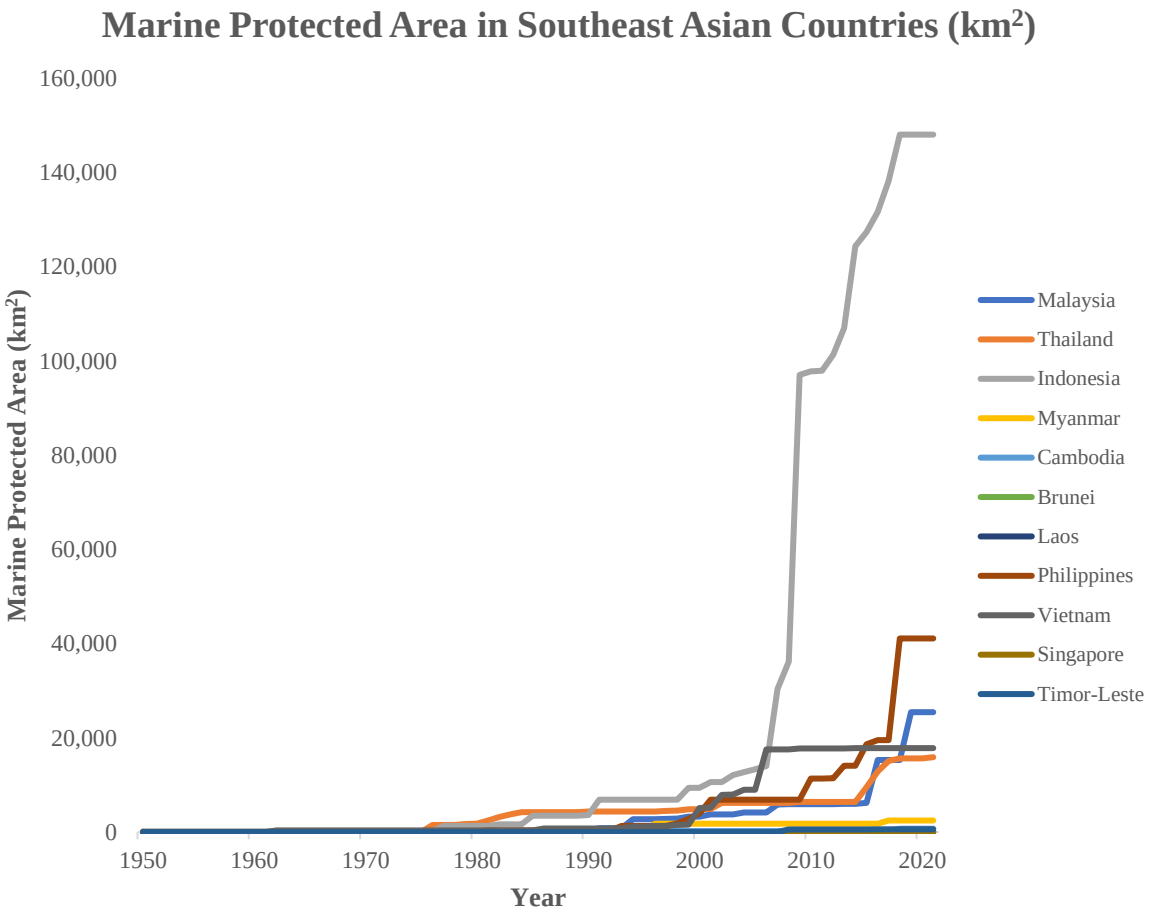
Notes. a. LAC – Latin American and Caribbean, MENA – Middle East and North America
b. The figure for ASEAN does not include Timor-Leste.
c. Percentages are derived by dividing total marine protected area by total marine area in the region/union.
Source: OECD Stat (2021)

Figure 5 presents the trend of MPA in selected global regions and union between 1950 and 2020. The Latin America and Caribbean (LAC) and Organization for Economic Cooperation and Development (OECD) recorded a significant increase in MPA coverage since 2020. In 2020, LAC had the highest MPA coverage at 23.7%, which is followed by the OECD at 21.5%. The percentages of MPA for ASEAN and Middle East and North Africa (MENA) have, on the other hand, remained relatively stagnant between 1950 to 2000. In 2020, ASEAN's MPA coverage was at 2.4%, and MENA's MPA coverage was around 1%.

Of the 11 SEA countries, Indonesia has the largest marine and coastal area, followed by the Philippines, Vietnam, Myanmar, Malaysia, Thailand, Cambodia, Timor-Leste, and Brunei. Laos is a landlocked country; hence it does not possess any marine and coastal area (Protected Planet, 2022) (refer to Figure 6 for an overview and Appendix 1 for the specific figures). While Indonesia possesses the largest marine and coastal area, it has only the third-highest percentage of MPA coverage at 3.06%, which is below Thailand at 4.44%; the country that has the highest percentage of MPA coverage is Malaysia at 5.56% (Protected Planet, 2022) (refer to Figure 7 for an overview and Appendix 1 for the specific figures). Conversely, countries with the lowest percentage of MPA coverage are Singapore (0.01%) and Brunei (0.2%). While Vietnam and Myanmar are among the countries with the biggest marine and coastal areas (second and third, respectively), they have the third and fourth lowest MPA coverage, percentage-wise, at 0.56% and 0.48%, respectively.

Figure 6.

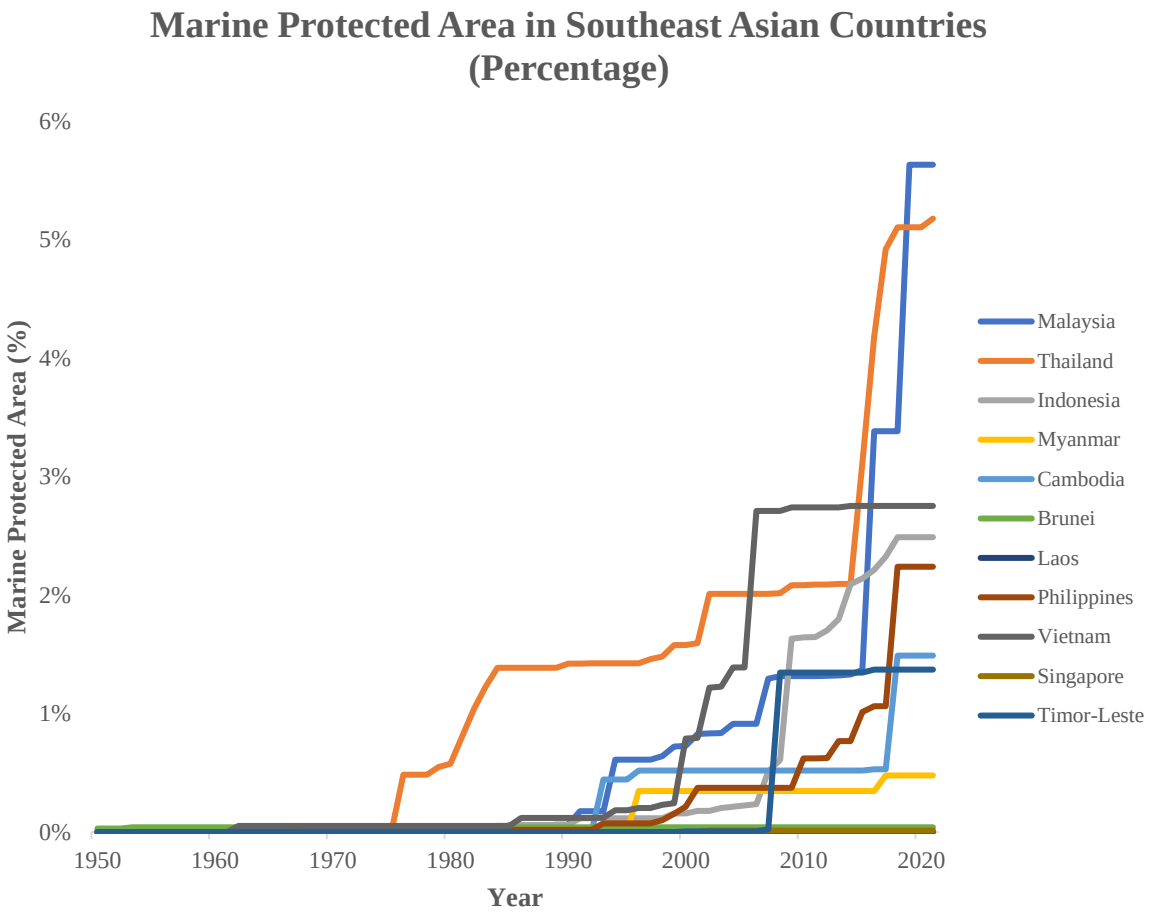
The trend of Marine Protected Areas from 1950 to 2020 in km²



Note. The figures are derived from the dataset downloaded from the Protected Planet (2022) website.
Source: Protected Planet (2022)

Figure 7.

The trend of Marine Protected Areas from 1950 to 2020 in percentage



Note. The figures are derived from the dataset downloaded from the Protected Planet (2022) website.
Source: Protected Planet (2022)

These figures fall far short of the Aichi Target 11 and 30 by 30 Initiative. Aichi Target 11 and the 30 by 30 initiatives are among the ambitious biodiversity conservation targets instituted by international organizations. Specifically, the Aichi Target 11 is one of the 20 targets in the Strategic Plan for Biodiversity created by the Convention on Biological Diversity (CBD), a multilateral environmental treaty that aims to conserve biodiversity, as well as to ensure a sustainable, fair, and equitable sharing of benefits that arise from genetic resources (Bhola et al., 2021). In particular, this target calls for the conservation of "*at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas*

of particular importance for biodiversity and ecosystem services … through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes" by 2020 (IUCN, 2022c, para. 3). As a continuation of Aichi Target 11, the High Ambition Coalition for Nature and People launched the 30 by 30 in 2020, which was later promoted at the 15th Conference of the parties to the convention (COP 15) of the CBD (Mukpo, 2021). This initiative is also supported by the Global Ocean Alliance, which is a UK-led initiative that comprises 71 members across the globe (Gov.UK, n.d.). Similar to the Aichi Target 11, the 30 by 30 initiative creates a quantitative goal for the coverage of protected areas to halt biodiversity loss (Mukpo, 2021). Specifically, this plan aims to preserve 30% of global land and sea areas by 2030 through area-based conservation methods (Mukpo, 2021). As of the end of 2021, more than 70 countries have committed to this ambition (Taylor, 2021).

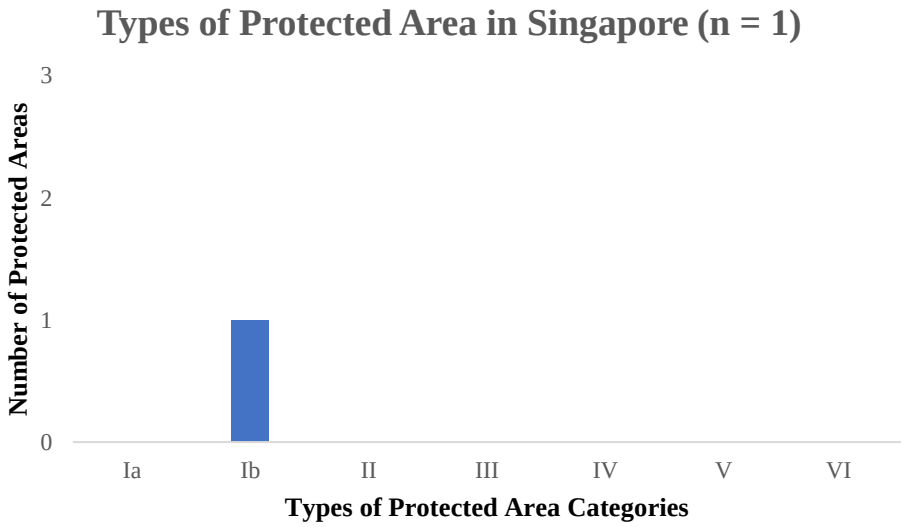
PAs are classified based on distinct management objectives. In particular, there are six categories to cater to different objectives: category I is divided into Ia: strict nature reserve and Ib: wilderness area, category II: national park, category III: natural monument or feature, category IV: habitat/species management area, category V: protected landscape/seascape, and category VI: PA with sustainable of natural resources (IUCN, 2022b) (see Appendix 2 for detailed descriptions for the different categories). Before analysing the IUCN categories of MPAs in SEA, it should be cautioned that a large proportion of IUCN categories for Brunei, Myanmar, Philippines, Timor-Leste, and Vietnam are either "not reported"[1] (NR) or "not applicable"[2] (NA) (Protected Planet, 2022; UNEP-WCMC, 2016). In particular, 67% of Brunei's MPAs, 40% of Myanmar's MPAs, 91% of Timor-Leste's MPAs, and 67% of

[1] "Not reported" applies to PAs which category is unknown and/or relevant information has yet to be provided
[2] "Not applicable" refers to PAs that do not apply to any designation type within the IUCN PA management categories, such as World Heritage Sites and UNESCO MAB Reserves.

Vietnam's MPAs are NR, whereas 66% of the Philippine's MPAs are NA (see Appendix 3 for the breakdowns for each country's MPA based on the IUCN). As a whole, 22% of SEA's MPA are NA, and 14% are NR (Protected Planet, 2022). Figure 8 to Figure 17 present clear illustrations of IUCN categories for each SEA country, though the graphs have excluded data on categories NR, NA, and "not assigned"[3] (NS). Laos' information is also excluded as it is a landlocked country.

Figure 8.

Types of Protected Areas in Singapore

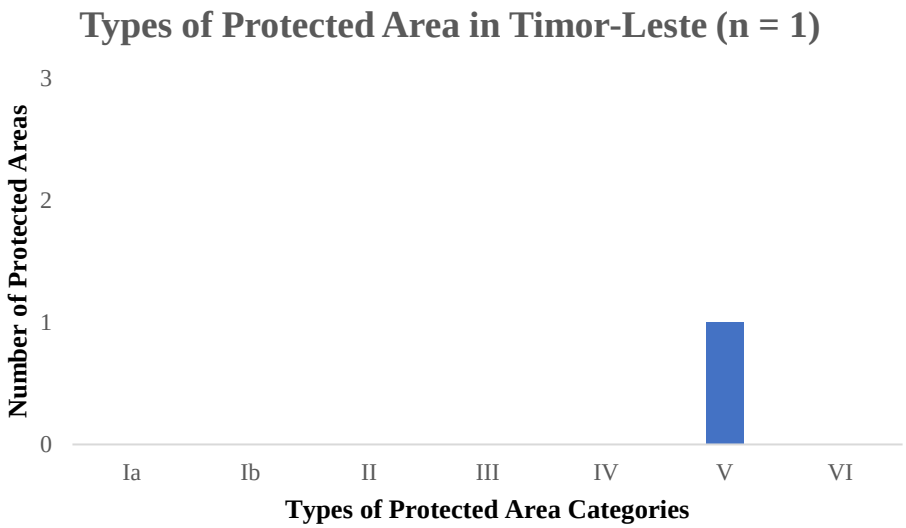


Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

[3] "Not assigned" is applicable when the data provider opts to not utilize the IUCN PA Management Category, though the PA meets the standard definitions

Figure 9.

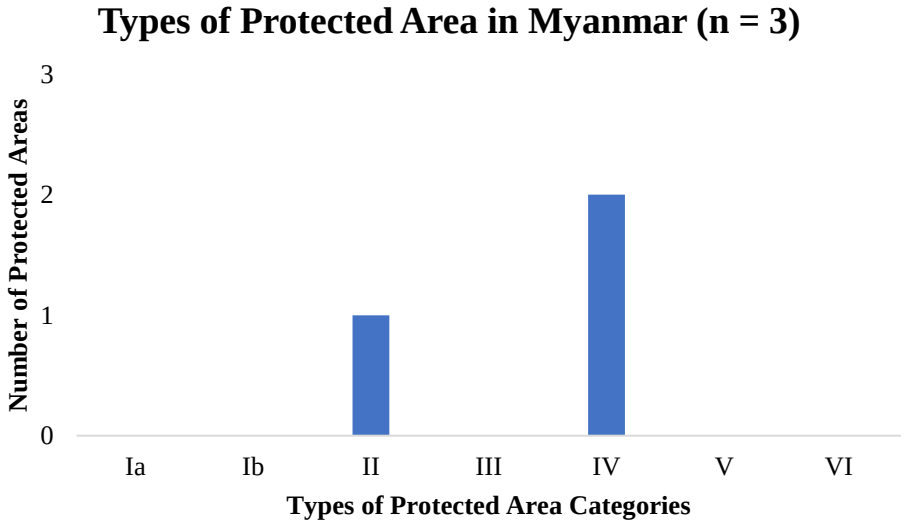
Types of Protected Areas in Timor-Leste



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 10.

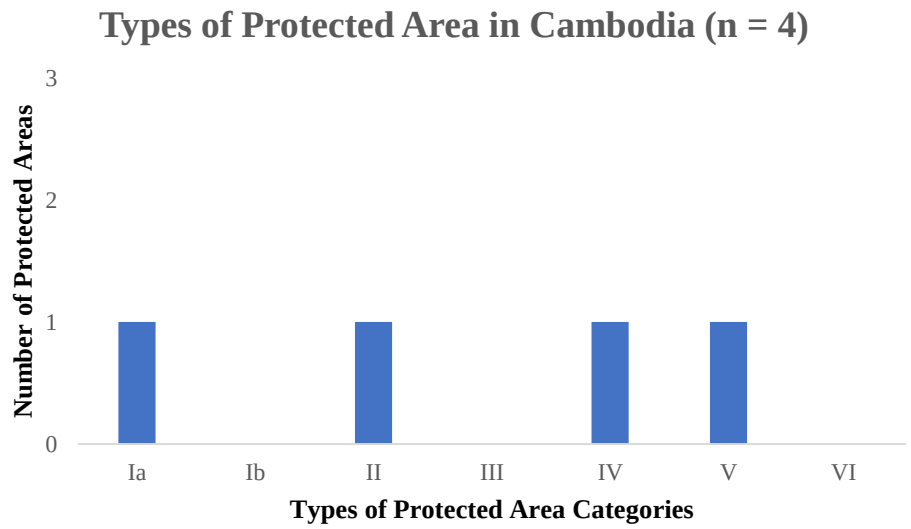
Types of Protected Areas in Myanmar



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 11.

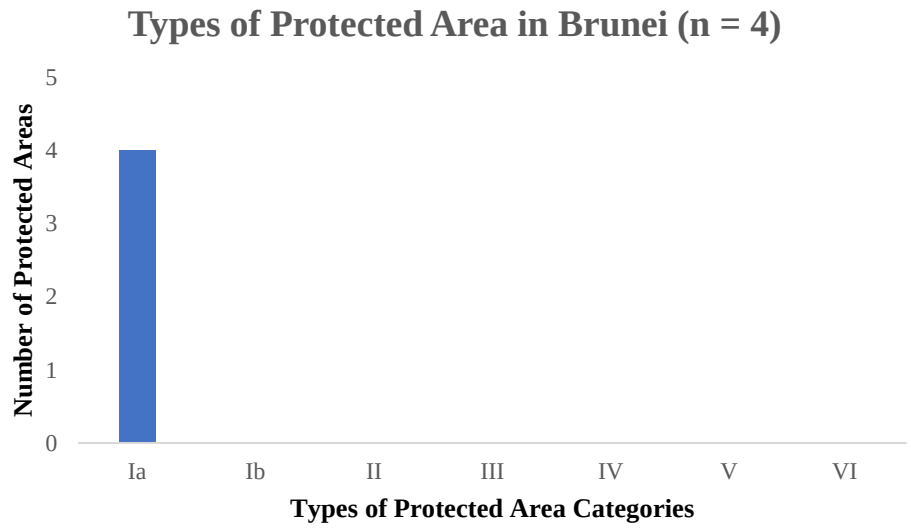
Types of Protected Areas in Cambodia



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 12.

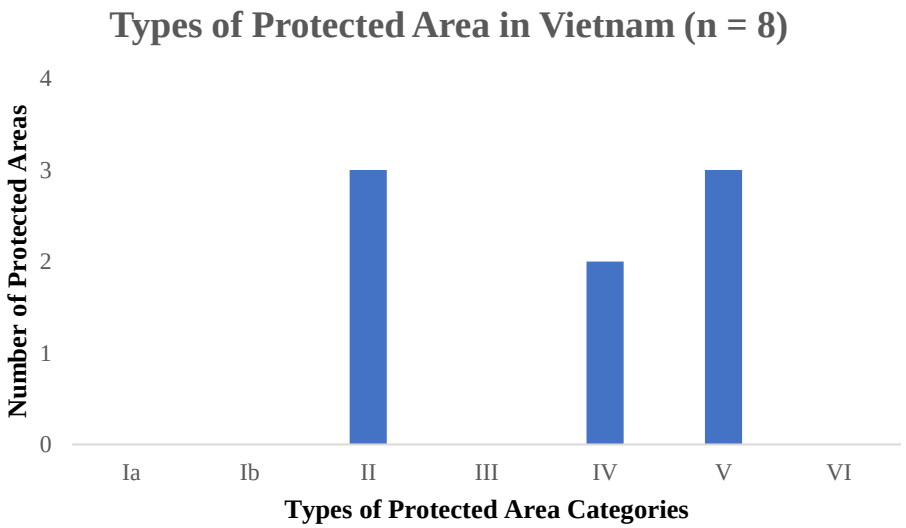
Types of Protected Areas in Brunei



*Notes.*a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 13.

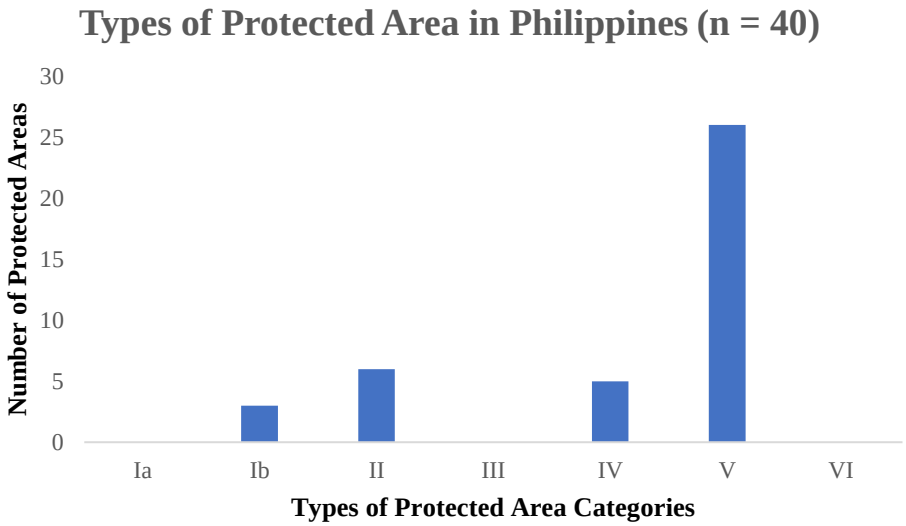
Types of Protected Areas in Vietnam



Notes.a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 14.

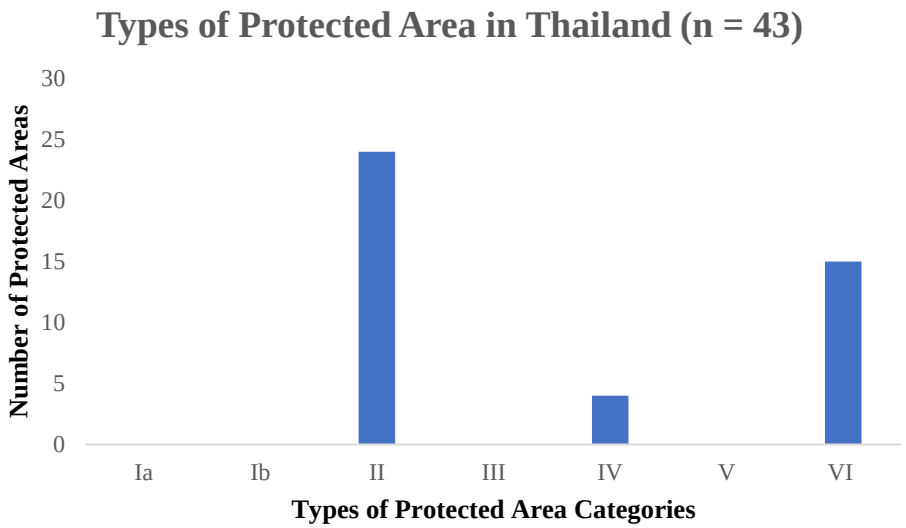
Types of Protected Areas in the Philippines



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 15.

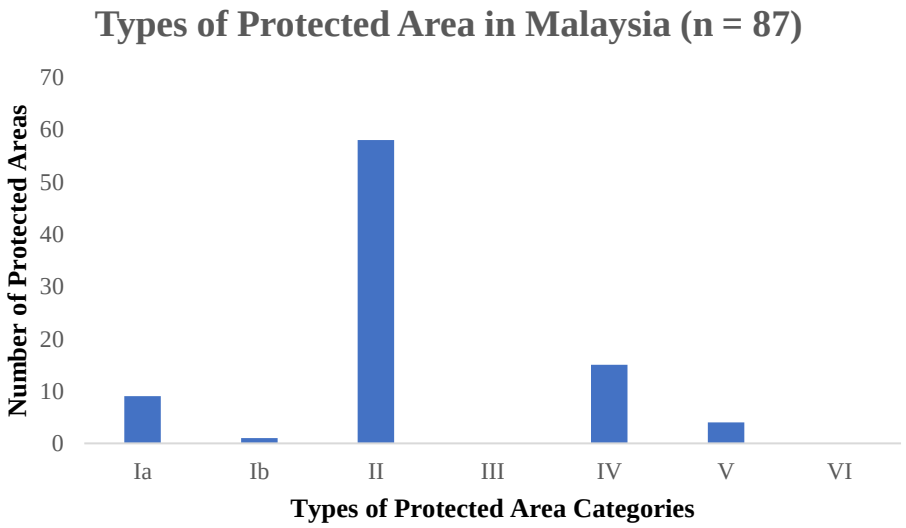
Types of Protected Areas in Thailand



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 16.

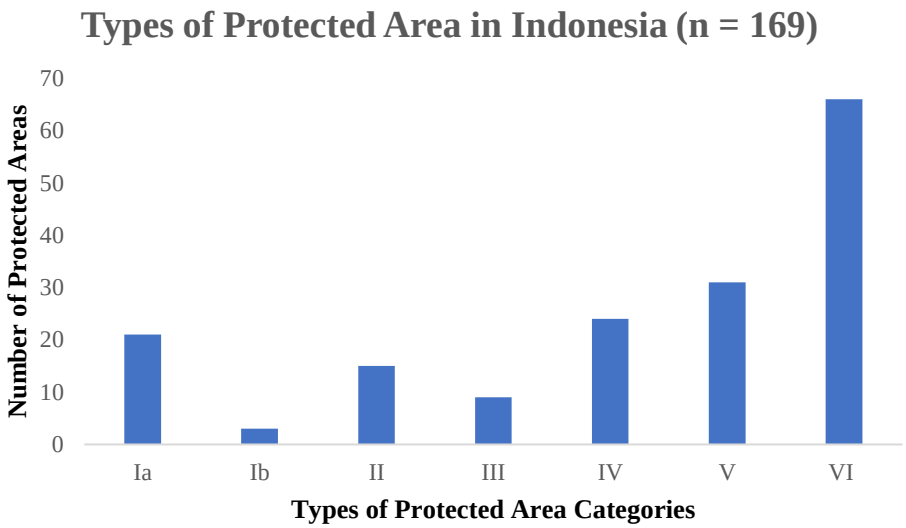
Types of Protected Areas in Malaysia



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 17.

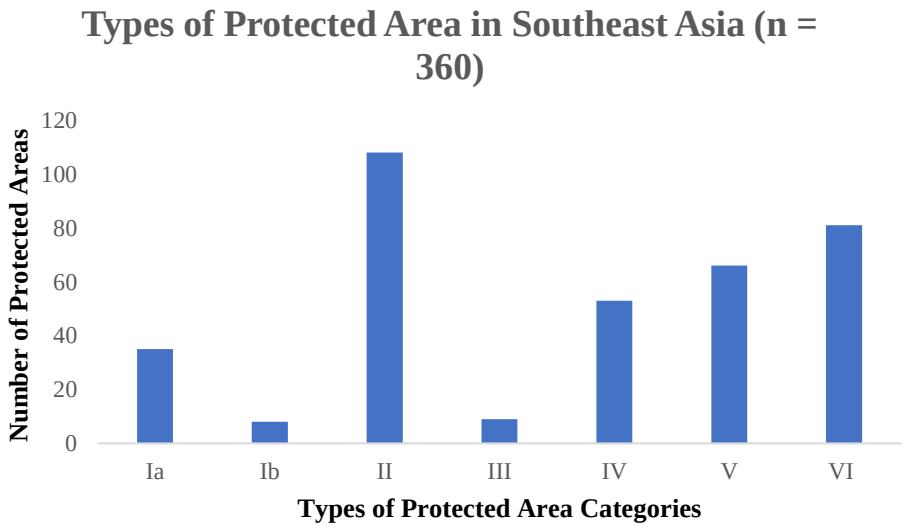
Types of Protected Areas in Indonesia



Notes. a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

Figure 18.

Types of Protected Areas in Southeast Asia



Notes.a. n = total number of marine protected area
b. Data excludes protected areas that are classified as not recognized, not applicable, and not assigned.
Source: Protected Planet (2022)

As shown by the figures, the compositions of IUCN categories vary between countries. For instance, while Brunei has only MPAs in category Ia (i.e., 4), the Philippines does not have any MPAs in category Ia but in categories Ib, II, IV, and V. For countries that have equal to or more than 40 MPAs (i.e., Philippines, Thailand, Malaysia, and Indonesia), there are clearer preferences for specific PA management categories. In particular, there are inclinations towards category II for Thailand and Malaysia, category V for the Philippines, and category VI for Indonesia. Excluding NR, NA, and NS, the largest proportion of MPAs in the SEA are in category II, followed by categories VI, V, IV, I, and III.

According to the IUCN (2013), this categorization system is not intended to be hierarchical, as the type of PAs to utilize depends on several factors, all of which are vital considerations to maximize conservation opportunities and address conservation threats. Examples of such factors include the needs and urgency of biodiversity conservation, unique features, land ownership patterns, long-term goals, the strength of governance, and population level. For research purposes, studies have classified categories Ia, Ib, II, and III as fully PA, and classified categories IV, V, and VI as partially PA (Turnbull et al., 2021). In particular, partial PA may provide leverage in enabling certain social or targeted ecological outcomes, such as allowing traditional fishing practices or protecting certain marine species (Turnbull et al., 2021). However, studies have pointed out the marginal or insignificant biodiversity contributions of partially PA due to the inability to remove human pressures within the area, which may eventually lead to the failure to achieve desired outcomes (e.g., Sala & Glakoumi, 2018; Turnbull et al., 2021). It would be beneficial for future studies to explore this relationship between the different IUCN categories and the effectiveness of biological conservation, particularly in the context of SEA.

2.2 Key Benefits of Marine Protected Areas in Southeast Asia

Effectively managed MPA in the region has pronounced benefits on the biophysical aspects of the marine ecosystem, particularly the density and biomass of marine biodiversity (Kamil et al., 2017). For instance, in the well-managed no-take zone on the Apo Island, Philippines, the biomass of Acanthuridae and Carangidae reef fish tripled over 18 years (Russ et al., 2004). The increased fish biomass within the reserve has spillover effects on areas outside the reserve. In particular, not only was the fish biomass higher in areas near the reserve, but the catch per unit effort also increased both inside and outside the MPA (Russ et al., 2004). In addition to fish density and biomass, coral cover has recorded improvements. For example, a four-year study at the Decalve MPA, Bugor-Sand MPA, and Bintuan MPA by Garces and colleagues (2013) revealed an overall decrease in deal coral cover inside the MPA and an increase in live coral cover outside the MPA, though the changes in coral cover vary between the three MPAs.

MPAs that are effectively managed also result in positive social benefits. For instance, the gazettement of Redang Island Marine Park and Tioman Island Marine Park in Malaysia has led to enhancements in community infrastructure (Mohd Salleh et al., 2011). In particular, the majority of respondents have indicated that infrastructures such as water supply, electricity, hospitals/clinics, schools, and community halls have improved since the establishment of marine parks (Mohd Salleh et al., 2011). In addition, some studies have shown that establishing MPAs has, directly and indirectly, aided in increasing the level of understanding and positive perceptions among local communities (Kamil et al., 2017). For example, the local community at Mabini in the Philippines believes that fish and coral reef conditions have improved after turning the area into an MPA (Christie, 2005, as cited in Kamil et al., 2017). A five years longitudinal study at the Raja Ampat MPA indicated that education and outreach activities

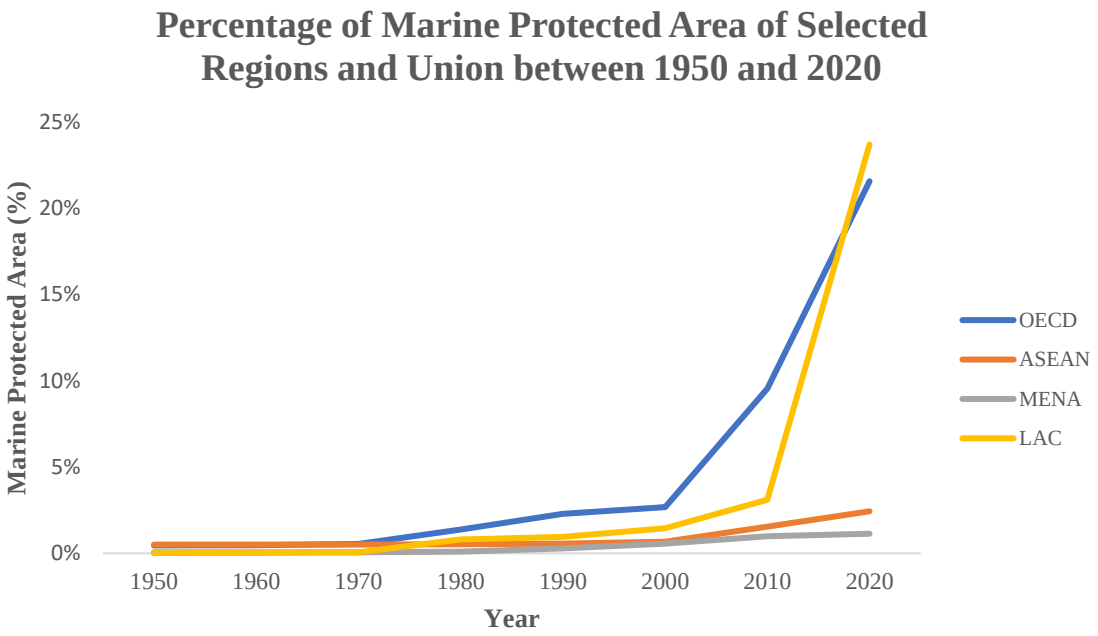
successfully increased knowledge and positive attitudes among the local communities (Leisher et al., 2012). Nonetheless, not all studies on MPAs yielded positive outcomes, as there exist critical flaws in the design and management of MPAs in SEA. The following section will discuss and elaborate on these flaws that exist in SEA's MPA system.

2.3 Key Flaws or Challenges of Marine Protected Areas in Southeast Asia

As a whole, the SEA countries still lag behind developed nations in implementing MPAs. As shown in Figure 19, ASEAN has significantly lower MPA growth rates compared to the LAC region and the OECD (OECD Stat, 2021). It has a slightly higher percentage of MPA coverage as compared to the MENA region, which according to the Global Peace Index (2021), "*remains the world's least peaceful region*" (pp. 2, para. 7) and is one of the most vulnerable regions to degraded marine ecosystems (The World Bank, 2022).

Figure 19.

The trend of Marine Protected Area Coverage of Selected Regions and Union



Notes. a. LAC – Latin American and Caribbean, MENA – Middle East and North America
b. The figure for ASEAN does not include Timor-Leste.
c. Percentages are derived by dividing the total marine protected area by the total marine area in the region or union.
Source: OECD Stat (2021)

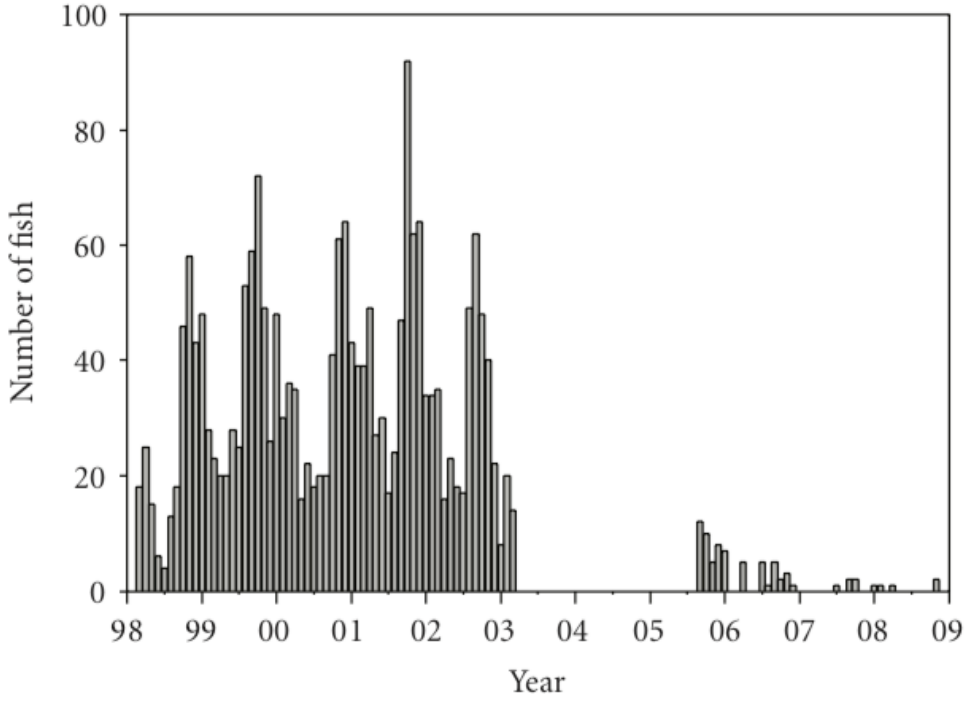
In addition to the lack of MPA coverage, a major barrier hindering the realization of marine biodiversity protection is the persisting occurrence of anthropogenic activities within MPAs (e.g., Bujan & Arquiza, 2021; Yunanto et al., 2018). Such activities include overfishing, the use of destructive fishing methods, as well as infrastructure constructions. While overfishing and destructive fishing methods in MPAs are less prevalent than in non-MPAs, these activities are, nonetheless, still taking place (e.g., Bujan & Arquiza, 2021; Yunanto et al., 2019). For instance, data collected in Indonesia's MPAs between 2012 and 2014 indicated consistent overfishing in Takabonerate and Aru (Yunato et al., 2019). In addition, destructive fishing activity was still rampant in the Selayar Regency (Yunato et al., 2019). Similarly, illegal fishing is still prevalent in the waters surrounding the Koh Rong Archipelago, which is Cambodia's first MPA (Roig-Boixeda et al., 2018). Tourism activities also contribute to problems, such as the increase in waste pollution and fin and anchor damage on coral reefs (Tejero, 2014). According to Abegg (2014), most MPAs in the Coral Triangle are not managed effectively due to the lack of good enforcement and governance.

As argued by Petit and colleagues (2018), while it is important to extend the coverage of PA, the continuous extension of PA coverage without a strong support system for proper implementation has minimal effects on meeting conservation goals and targets. This results in "paper parks", which are MPA designations that lack ample enforcement and management in practice (Our Shared Seas, 2022). This is especially relevant in SEA, where the lack of effective enforcement is one of the main factors driving the persisting detrimental anthropogenic activities in MPAs. As highlighted in many studies, there are weak monitoring and law enforcement within the MPAs in SEA (Conservation International, 2016; Roig-Boixeda et al., 2018; Walton et al., 2015). For instance, the lack of monitoring and patrolling activities enabled continuous illegal fishing within the no-take zone in Komodo National Park, a marine

biodiversity-rich environment within the Coral Triangle (Mangubhai et al., 2011). In the Komodo National Park, authorities prosecuted those who performed destructive fishing methods such as bomb fishing and cyanide. However, little was done to prosecute individuals who fished within no-take zones (Mangubhai et al., 2011). As a result of lapses in monitoring (especially between 2003 and 2005) in enforcement (especially between 2004 and 2005), decades would be needed to restore the populations of *Plectropomus areolatus* aggregations, one of the fish species which is known to have high economic value (Mangubhai et al., 2011) (see Figure 20).

Figure 20.

Number of Plectropomus areolatus Recorded at Fish Spawning Aggregation Sites from March 1998 to December 2009



Note. This graph illustrates fish aggregations only during the main moon phases. Enforcement from 2004 to 2005 was at the lowest in a decade. No data were collected from April 2003 to August 2005.
Source: From Mangubhai, S., Saleh, M., Muljadi, A., Rhodes, K. L., & Tjandra, K. (2011). Do not stop: the importance of seamless monitoring and enforcement in an Indonesian marine protected area. *Journal of Marine Biology, 2011*, 501465. Copyright 2011 by Mangubhai

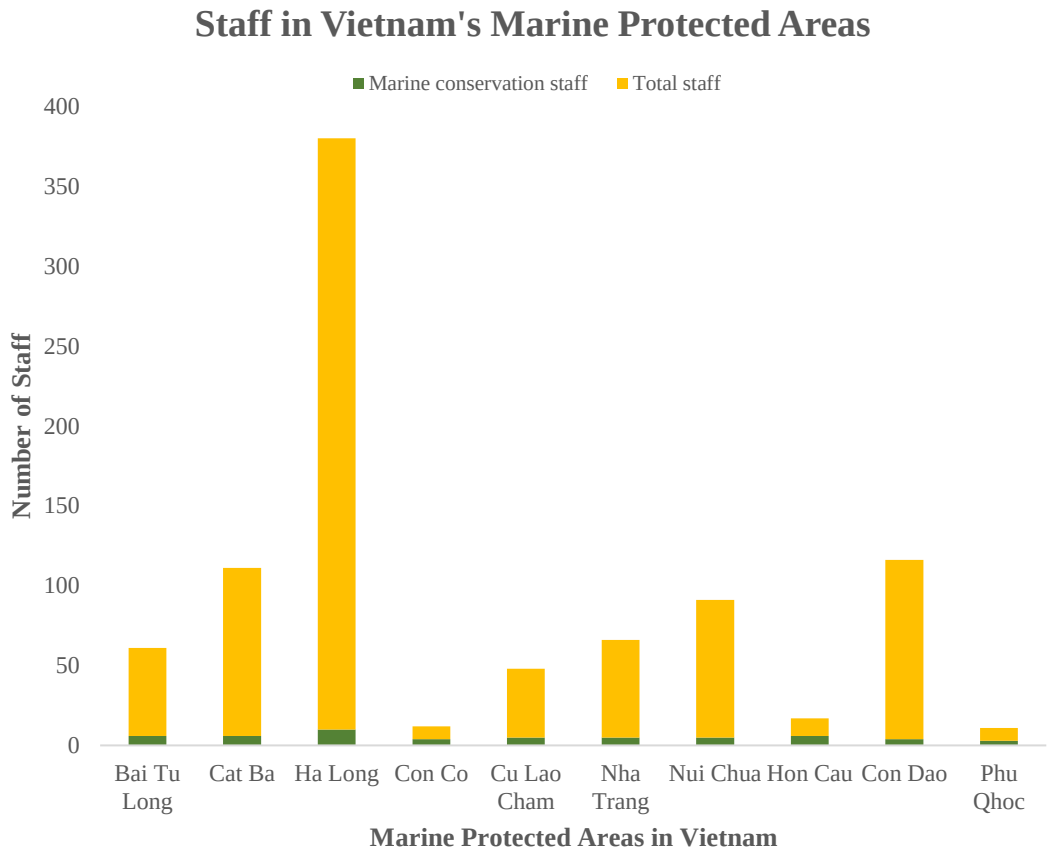
In addition, legislations gaps and inconsistencies have resulted in insufficient MPA protection. For instance, in the Verde Island Passage and Davao Gulf sites with 38 and 19 MPAs, respectively, reclamation and construction at the foreshore have persisted unabated (Bujan & Arquiza, 2021). These activities took place despite opposition from the Philippine local government units. One of the main reasons for such occurrence is the inconsistencies in foreshore governance: the licensing and monitoring of foreshore lease agreements (FLAs) by the DENR Land Management Unit are not in coordination with the local government units' land use plans. In particular, the land classification subjacent of FLAs have weak enforcement and coastal ecosystems protection rights. This enables FLAs' legal holders to continue operating in ways that are harmful to marine ecosystems (Bujan & Arquiza, 2021). Malaysia's MPA management faces a similar situation, where the dichotomy in jurisdictions between the federal and state governments has resulted in inefficient and unsustainable management of MPAs (Islam, 2014). In particular, the state government is responsible for land matters on the marine park islands, while the federal government manages the jurisdiction of water areas up to two nautical miles surrounding the island. This dichotomy in jurisdictions between the federal and state governments has resulted in inefficient and unsustainable management of MPAs (Islam, 2014).

Moreover, many MPAs within SEA lack the necessary staff capacity and funds to ensure the proper execution of essential management activities (e.g., Conservation International, 2016; Hockings et al., 2012; Tejero, 2014; Walton et al., 2015). These are serious issues, as well-resourced staffing and financial capacity are keys to executing effective administration, monitoring, enforcement, and community engagement, among other tasks (Gill et al., 2017; Our Shared Seas, 2022). For instance, the severe lack of funds for Vietnam MPAs has impeded the purchase of basic facilities and infrastructure, such as boats and diving

equipment (Walton et al., 2015). The absence of these equipment pieces essential for monitoring work has led to the "non-existent" surveillance and law enforcement in these areas (Walton et al., 2015, p. 11). In addition to the amount of staff (see Figure 21), staff competence has also been severely lacking. In particular, all staff in Vietnam's MPAs do not possess professional backgrounds in marine biology, and most of them have been trained as foresters (Walton et al., 2015). Similarly, limited training opportunities combined with a paucity of formal marine conservation-related qualifications have resulted in a poorly skilled workforce among MPAs staff in Thailand (Hockings et al., 2012).

Figure 21.

Staff Capacity at Vietnam's Marine Protected Areas



Note. Marine conservation staff refers to personnel in specific marine conservation-related departments (e.g., marine research and development department and wetland conservation department). The others involve staff responsible for other aspects of MPAs, such as tourism.
Source: Walton et al. (2015)

In addition to the skills required for proper evaluation, monitoring, and marine research work, staff across many MPAs in the region lack the business and entrepreneurial skills needed to expand and diversify revenue opportunities, as well as to carry out vital business interests on an equal footing (Hockings et al., 2012). It is important to address this issue as it hinders the creation of financial sustainability for MPAs, which is critical in ensuring effective management of PAs in the long run (United Nations Environment Programme, 2014). Moreover, developing governments' allocations of conservation investment are typically lower or more difficult to acquire than those of developed countries, making it more crucial for staff in developing countries to possess business skills (Birdlife International, 2004). For instance, in many SEA countries, the major funders for MPAs are the national governments (Cripps, 2020; United Nations Development Programme, 2014). Those with fewer resources have to be more dependent on aid from international organizations, philanthropic foundations, and NGOs to fill the financial gaps (Cripps, 2020; United Nations Development Programme, 2014). Thus, possessing the know-how to foster sustainable tourism and attract additional funding sources is critical to ensuring the long-term financial sustainability of MPAs.

Finally, authorities need to reflect on their relationships with local communities, as the success of MPAs is heavily dependent on positive perceptions and engagement with the local populations (Benette & Dearden, 2014). In some instances, the establishment of MPAs has resulted in serious conflicts between the authorities and local communities, causing hindrances in achieving both biological and socio-economic goals in MPAs. For instance, the governance switch from community-based to central governance on Balicasag Island has obtained minimal support from the local community (Christie, 2004). As a result, fish populations within the no-take area recorded a drastic decline (Christie, 2004). In particular, fish populations of targeted species have declined 291% within 13 years because of the increase in poachers that were

formerly supportive community members. In general, conflicts or disagreements arise as the locals feel undermined and restricted by the laws (Kamil et al., 2017). Moreover, they are also dissatisfied with the lack of job alternatives, in addition to the loss of earning opportunities because of tourism operators (Kamil et al., 2017). These circumstances are attributable to two overarching factors: (i) shortcomings in governance and communication and (ii) indirect livelihood consequences from governance.

One of the reasons for governance shortcomings is the complexity and myriad factors involved in executing optimal MPA governance (Kamil et al., 2017; Masud et al., 2022). There are several MPA management approaches: centralized (i.e., top-down), community-based (i.e., bottom-up), and collaborative management (i.e., shared power between the authorities and locals) (Kamil et al., 2017; Masud et al., 2022). According to a literature review by Kamil and colleagues (2017), there has been a transition of MPA management approaches in SEA, particularly from community-based MPA to more centralized management. However, findings and opinions on the superiority of management approaches are mixed. There are pros and cons with both approaches: bottom-up community-based management takes into consideration issues of local communities, while the top-down MPA management approach enables effective resource management and utilization, as well as ensures functional connectivity of areas (Kamil et al., 2017; Marriot et al., 2021; Masud et al., 2022). Studies have also shown support for collaborative management as it fosters both economic development and dispute management between the government and local communities. (e.g., Masud et al., 2022). However, this approach, too, has its shortcomings. In particular, effective communication and cooperation in this management approach are crucial to producing fruitful results. In addition to the respective challenges, the suitability of management approaches needs to consider a range of localized factors, such as socio-political and present socio-economic contexts. For example, while the

institution of the National Integrated Protected Areas System (NIPAS) in the Philippines has reinforced several MPAs in the country, it has undermined the management of the previously successful community-based MPAs in Apo Island (Christie & White, 2007). Thus, while collaborative management is generally agreed to be the best management approach, given the complexity of executing this strategy as well as the myriad factors present in different socio-contexts, it is a challenging task to execute optimum governance that maximizes MPA development and well-being of local communities (Kamil et al., 2017; Masud et al., 2022).

Regardless of the management approach types, communication between the authorities and local communities needs to be improved, as studies have indicated a lack of effective communication between both parties in SEA's MPAs (e.g., Christie & White, 2007; Islam, 2014; Kamil et al., 2017; Masud et al., 2022). Effective communication is a two-way process: to understand local opinions when informing MPA management, but also to foster understanding of MPA management within the local communities (Trajano et al., 2018). Understanding local perceptions is the key to uncovering reasons for non-compliance in MPAs (Roig-Boxeda et al., 2018). Fostering understanding, on the other hand, is important to increase awareness and understanding of MPA's importance and benefits, as insufficient understanding may increase resistance to rules adherence, as well as in the engagement of local communities in MPA management (Trajano et al., 2018). For instance, some coastal communities in the Philippines have negative perceptions of MPAs (Yan, 2016). In particular, instead of being an important tool to conserve biodiversity, MPAs are viewed as a hindrance to their ability to carry out fishing activities in front of their homes. All in all, both understanding and fostering understanding are imperative to carrying out effective MPA management.

In addition, while several studies have indicated modestly positive socio-economic outcomes, the overall impacts of MPAs on livelihoods are mixed and heterogenous (Benette &

Dearden, 2014). In particular, while the establishment of MPAs has fostered a certain degree of livelihood diversification, especially in the tourism and hospitality industries, studies have suggested some unintended negative consequences from several MPA implementations (Haenssgen et al., 2021). For instance, conservation management efforts by community fishery organizations in Koh Sdach – a soon-to-be MPA in Cambodia – did not discernibly enhance fishing-dependent livelihoods. Instead, these efforts are said to have resulted in divided and agitated communities "locked" in a cycle of marine resource dependence (Haenssgen et al., 2021, p. 11). This phenomenon has been attributed to the lack of consideration of local social contexts, as well as the absence of support to carry out livelihood adaptation among the affected communities (Haenssgen et al., 2021). In another study measuring the perceived impacts of 17 national marine parks in Thailand, local communities perceive little employment benefits from tourism and marine parks management, except for selected elites that would gain significantly (Benette & Dearden, 2014). Furthermore, negative implications were perceived as a result of developmental lag and diminished access to social, cultural, and financial assets.

The limited contribution of tourism revenues to the local economy further contributes to the attenuation of livelihood in some MPAs (Kamil et al., 2017). For instance, a study by Yacob and colleagues (2007) indicated that tourism revenues in Malaysia Redang Marine Park scarcely contribute to the local economy. This is because only one-third of the benefits were retained in the country (and even a smaller proportion in the marine park), while the majority of revenues were "leaked" to overseas airlines and operators (Yacob et al., 2007, p. 7). A more recent study by Pham (2020) in the Vietnam Nha Trang Bay MPA has found similar findings, where tourism did not provide sufficient employment opportunities or income to the local communities. In particular, tourism investors outside of the MPA are the beneficiaries of

tourism revenue, whereas the share of revenue allotted to the local community is modest (Pham, 2020).

3. Concluding Remarks

Blessed with a rich and unique marine natural heritage, SEA is recognized as one of the world's marine biodiversity hotspots. Nonetheless, with the heavy anthropogenic pressures driven by the increasing population and rapid economic growth, the marine ecosystem in SEA has embarked on a path of deterioration since the mid-1950s. To halt the continuous degradation of marine ecosystems and to achieve the post-2020 global biodiversity and sustainability goals, MPAs have been instituted and recognized as one of the vital environmental conservation measures. Currently, SEA's MPA coverage still falls far short of international targets, such as the Aichi Target 11 and 30 by 30 initiatives.

Indeed, quantitative goals present clear targets that countries need to strive to achieve. However, it is vital to ensure the presence of key enabling conditions to achieve successful MPAs in addition to achieving the quantitative targets. While successful MPAs offer significant benefits, such as improving biophysical elements of marine ecosystems and providing socio-economic benefits to local communities, critical flaws are present in the current SEA MPA system. In addition to the fundamental lack of MPA coverage, harmful anthropogenic activities still occur within the MPAs. Several reasons for this persisting condition include weak monitoring and law enforcement, gaps, and inconsistencies in current legislation, as well as funding and staff deficiencies. Finally, it is vital to address the issues concerning the local communities in MPAs, as the lack of support and understanding from the locals seriously undermines MPA development and effectiveness. In particular, the suitability and effectiveness of governance methods need to be further explored in different social

contexts. Moreover, the consequences of MPA governance and establishment on locals' livelihoods need to be further examined.

4. References

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5. Appendix

Appendix 1. *Marine Protected Area in Southeast Asia.*

	Total marine & coastal area (km^2)	No. of marine protected area	No. of partial marine protected area	Marine protected area coverage km^2	Marine protected area coverage %
Brunei	25,698	11	1	52	0.20
Cambodia	47,967	0	4	691	1.44
Indonesia	5,947,954	97	101	181,865	3.06
Laos	0	0	0	0	0
Malaysia	451,742	69	22	25,099	5.56
Myanmar	514,147	0	5	2,457	0.48
Philippines	1,835,028	137	43	32,010	1.74
Singapore	763	1	0	0	0.01
Thailand	306,891	16	28	13,635	4.44
Timor-Leste	42,501	6	5	583	1.37
Vietnam	647,232	10	36	3,630	0.56

Total	9,819,923	347	245	260,022	0.03

Source: Protected Planet, 2022

Appendix 2. *Definitions of IUCN Protected Area Categories.*

Categories		Descriptions
Ia	Strict nature reserve	Strictly protected for biodiversity and also possibly geological/ geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values
Ib	Wilderness area	Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition
II	National park	Large natural or near-natural areas protecting large-scale ecological processes with characteristic species and ecosystems, which also have environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities
III	Natural monument or feature	Areas set aside to protect a specific natural monument, which can be a landform, sea mount, marine cavern, geological feature such as a cave, or a living feature such as an ancient grove
IV	Habitat/species management area	Areas to protect particular species or habitats, where management reflects this priority. Many will need regular, active interventions to meet the needs of particular species or habitats, but this is not a requirement of the category
V	Protected landscape/seascape	Where the interaction of people and nature over time has produced a distinct character with significant ecological, biological, cultural and scenic value: and where safeguarding the integrity of this interaction is vital to protecting and sustaining the area and its associated nature conservation and other values

VI	Protected area with sustainable use of natural resources	Areas which conserve ecosystems, together with associated cultural values and traditional natural resource management systems. Generally large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims

Note: The category given is based on the primary management aims, which should be applied to at least 75% of the protected area

Source: IUCN, 2013

Appendix 3. *Respective counts of IUCN Categories of Marine Protected Area in Southeast Asia.*

		Ia	Ib	II	III	IV	V	VI	Not reported	Not applicable	Not assigned	Total
Brunei	*Partial marine*	1	0	0	0	0	0	0	0	0	0	1
	Complete marine	3	0	0	0	0	0	0	8	0	0	11
	Total	4	0	0	0	0	0	0	8	0	0	12
	%	33%	0%	0%	0%	0%	0%	0%	67%	0%	0%	100%
Cambodia	*Partial marine*	1	0	1	0	1	1	0	0	0	0	4
	Complete marine	0	0	0	0	0	0	0	0	0	0	0
	Total	1	0	1	0	1	1	0	0	0	0	4
	%	25%	0%	25%	0%	25%	25%	0%	0%	0%	0%	100%
Indonesia	*Partial marine*	15	3	6	4	13	23	24	10	3	0	101
	Complete marine	6	0	9	5	11	8	42	15	1	0	97
	Total	21	3	15	9	24	31	66	25	4	0	198
	%	11%	2%	8%	5%	12%	16%	33%	13%	2%	0%	100%
Laos	*Partial marine*	0	0	0	0	0	0	0	0	0	0	0
	Complete marine	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0
	%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Malaysia	*Partial marine*	8	0	9	0	4	1	0	0	0	0	22
	Complete marine	1	1	49	0	11	3	0	4	0	0	69

	Total	9	1	58	0	15	4	0	4	0	0	91
	%	10%	1%	64%	0%	16%	4%	0%	4%	0%	0%	100%
Myanmar	*Partial marine*	0	0	1	0	2	0	0	2	0	0	5
	Complete marine	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	1	0	2	0	0	2	0	0	5
	%	0%	0%	20%	0%	40%	0%	0%	40%	0%	0%	100%
Philippines	*Partial marine*	0	1	2	0	4	14	0	0	3	19	43
	Complete marine	0	2	4	0	1	12	0	2	115	1	137
	Total	0	3	6	0	5	26	0	2	118	20	180
	%	0%	2%	3%	0%	3%	14%	0%	1%	66%	11%	100%
Singapore	*Partial marine*	0	0	0	0	0	0	0	0	0	0	0
	Complete marine	0	1	0	0	0	0	0	0	0	0	1
	Total	0	1	0	0	0	0	0	0	0	0	1
	%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	100%
Thailand	*Partial marine*	0	0	13	0	4	0	11	0	0	0	28
	Complete marine	0	0	11	0	0	0	4	0	1	0	16
	Total	0	0	24	0	4	0	15	0	1	0	44
	%	0%	0%	55%	0%	9%	0%	34%	0%	2%	0%	100%
Timor-Leste	*Partial marine*	0	0	0	0	0	0	0	5	0	0	5
	Complete marine	0	0	0	0	0	1	0	5	0	0	6

	Total	0	0	0	0	0	1	0	10	0	0	11
	%	0%	0%	0%	0%	0%	9%	0%	91%	0%	0%	100%
Vietnam	*Partial marine*	0	0	3	0	1	3	0	22	7	0	36
	Complete marine	0	0	0	0	1	0	0	9	0	0	10
	Total	0	0	3	0	2	3	0	31	7	0	46
	%	0%	0%	7%	0%	4%	7%	0%	67%	15%	0%	100%
Total	*Partial marine*	25	4	35	4	29	42	35	39	13	19	245
	Complete marine	10	4	73	5	24	24	46	43	117	1	347
	Total	35	8	108	9	53	66	81	82	130	20	592
	%	6%	1%	18%	2%	9%	11%	14%	14%	22%	3%	100%

Note: "Partial marine" consists of protected areas which are partially within the marine environmental (e.g., coastal), whereas "complete marine" consists of protected areas which are completely within the marine environment (e.g., ocean). Definitions can be obtained from the World Database on Protected Area's User Manual (UNEP-WCMC, 2016).

Source: Protected Planet, 2022

About Sunway IGSC

Sunway Institute for Global Strategy and Competitiveness (Sunway IGSC) is dedicated to extending its research focus beyond the traditional economic boundary of competitiveness and draws into its coverage social and environmental considerations as explicit factors of competitiveness.

Based on a more inclusive and holistic consideration, Sunway IGSC identifies three primary pillars of competitiveness: Economic, Social, and Environment. The three pillars of competitiveness provide direction and focus to the type of questions asked and the work conducted within IGSC:

- **Economic health -** This pillar investigates drivers of competitiveness from the vantage point of firms, industry, and national ecosystems, with a particular focus on policies and drivers of structure and competitive strategies to create positions of sustainable advantage.
- **Social health -** This pillar focuses on issues of distribution of wealth, equity, and unity within ecosystems as a consequence of economic policies and strategies at the firm, industry, and national levels. The lens scrutinizes who creates value, for whom, and how is this value distributed among the diverse stakeholders operating within the ecosystem. It stresses the need for inclusive creation and sharing of value creation to ensure shared prosperity.
- **Environment health -** This pillar scrutinizes how actions of individuals, firms, industry, and government impact the environment and draws into explicit consideration the need to go beyond the simple mantra of firm profit maximization and short-run economic development and competitiveness by holistic consideration of the costs to the natural environment and life of species, including that of the human race over the long run.

The mission of the Sunway IGSC is to conduct meaningful fundamental and translational research exploring global strategy and competitiveness to contribute to the strategic transformation and competitiveness of governments, industries, and society in the context of rapidly changing global dynamics.

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