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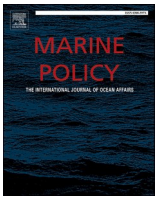

Marine conservation beyond MPAs: Towards the recognition of other effective area-based conservation measures (OECMs) in Indonesia

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ABSTRACT

In a marine environment that is rapidly changing due to anthropogenic activities and climate change, area-based management tools are often used to mitigate threats and conserve biodiversity. Marine protected areas (MPAs) are amongst the most widespread and recognized marine conservation tools worldwide, however, MPAs alone are inadequate to address the environmental crisis. The promotion of other effective area-based conservation measures (OECMs) under draft Target 3 of the Post-2020 Global Biodiversity Framework, i.e., conserving 30% of marine areas by 2030, holds promise to acknowledge sites and practices occurring beyond MPAs that contribute to conservation. Here, we evaluate the potential recognition of OECMs into Indonesia's national policy framework on marine resource management and provide the first-ever overview of distribution and types of potential marine OECMs in Indonesia, including a review of the existing evidence on conservation effectiveness. We identified > 390 potential marine OECMs, led by government, customary and local communities, or the private sector, towards diverse management objectives, including habitat protection, traditional/customary management, fisheries, tourism, or other purposes. While some evidence exists regarding the conservation effectiveness of these practices, the long-term impacts on biodiversity of all potential marine OECMs in Indonesia are unknown. Many OECM elements have been included in several national policies, yet there are no established mechanisms to identify, recognize and report sites as OECMs in Indonesia. We propose four transformational strategies for future OECM recognition in Indonesia, namely: (i) safeguard customary and

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traditional communities, (ii) leverage cross-sector and cross-scale collaboration, (iii) focus on delivering outcomes, and (iv) streamline legal frameworks. Our study shows that OECMs have the potential to play a significant role in underpinning marine area-based conservation in Indonesia, including supporting the Government of Indonesia in reaching national and international conservation targets and goals.

1. Introduction

Our oceans provide a wealth of benefits, from coastal protection to nutrition, livelihoods, and carbon storage, yet face increasing pressures, negatively impacting their health and the provisions they provide [1]. A range of conservation measures has been implemented in an attempt to mitigate these pressures, though area-based management has been the most widespread approach to protect ocean resources, primarily recognized through the implementation of marine protected areas (MPAs) [2,3]. First established in the early 1900s [2], the number of MPAs had reached almost 18,000 in 2021, covering almost 8% of the planet's oceans [4]. When well-managed, MPAs can provide multiple benefits for biodiversity, ecosystem health, fisheries, and human well-being [5–7]. MPAs have historically been government-led, and many are often 'top-down' in their approach [2], with little involvement of local communities [8]. While there are ongoing efforts to move towards shared-governance or co-management approaches in many MPAs [9,10], there are many forms of area-based management that provide conservation value but do not 'fit' within the MPA framework because they may not have conservation as their primary goal, and therefore, have not traditionally been seen to be contributing to area-based conservation [11]. Identifying, recognizing, and further supporting these other forms of area-based management can provide additional pathways to conserve biodiversity. This is critical, considering we have fallen short of achieving the 2020 Aichi Target 11 to protect 10% of the world's ocean [12] and with a view towards the new ambitious targets on the horizon set to be agreed upon at the fifteenth meeting of the Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) in early-2022.

In this context, the current draft Target 3 of the CBD post-2020 global biodiversity framework shows promise for the future of marine conservation because it places clear emphasis on area-based conservation efforts *beyond MPAs*, calling on Parties to '*Ensure that at least 30% globally of land areas and sea areas, especially areas of particular importance for biodiversity and its contributions to people, are conserved 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*' [13, emphasis added]. Introduced in 2010 and defined in 2018 [14], other effective area-based conservation measures (OECMs) have been acknowledged as a complementary framework to MPAs, and the CBD equally promotes both to achieve global conservation outcomes [15]. An OECM is defined as '*a geographically defined area other than a protected area, which is governed and managed in ways that achieve positive and sustained long-term outcomes for the* in-situ *conservation of biodiversity with associated ecosystem functions and services and where applicable, cultural, spiritual, socio-economic, and other locally relevant values*' [16]. OECMs differ from MPAs because they do not have to be dedicated to biodiversity conservation but must deliver long-term in-situ conservation benefits, whereas MPAs should have primary conservation objectives. Few global examples of area-based management that can be recognized as OECMs include, among others, fisheries closure areas in Canada [4], locally managed marine areas (LMMAs) in Mozambique [17], and territories and areas conserved by Indigenous peoples and local communities (ICCAs) in many parts of the world [18].

While there are increasingly more guidelines available (e.g., [14]), there is still relatively little application of the guidelines to 'real-life examples' of potential OECMs. Here, we provide one such attempt in Indonesia, a country with a rich history of traditional area-based conservation. Specifically, we provide an overview of Indonesia's existing area-based management practices and policies, explore the CBD criteria's application to a range of areas, and identify types and distribution of potential OECMs. We also review the existing evidence on the biodiversity benefits of different potential OECM types in Indonesia. In the end, we highlight the potential implications and provide a pathway and critical considerations for the formal recognition of OECMs in Indonesia.

2. Marine conservation in Indonesia

Indonesia's marine ecosystems provide valuable resources and benefits to support human well-being through fisheries, tourism, and many other ecosystem services [19,20]. However, intensified and widespread anthropogenic activities and impacts of climate change have put these marine resources in danger [19,20]. To reduce the threats and continue benefiting from these resources, both formal and customary biodiversity protection and sustainable marine management practices have been applied and, to some extent, embedded in the daily practices of the society in utilizing marine resources. In Indonesian law, natural resource conservation is defined as '*the management of natural resources where utilization is carried out sustainably to ensure resource continuity while maintaining and improving the quality of biodiversity and its values* (Law No. 5/1990).'

The Government of Indonesia implements biodiversity conservation and sustainable management by establishing protected areas (PAs). The state has applied this formal conservation tool since 1921 to protect valuable terrestrial species and habitats [21], and only after 1977 did the state start to establish MPAs [22,23]. MPAs in Indonesia are governed under legal frameworks established by two ministries, The Ministry of Marine Affairs and Fisheries (MMAF) and The Ministry of Environment and Forestry (MoEF). Each of these frameworks can be applied to establish MPAs which can be governed directly by the national government or provincial governments [24]. MPAs are spatially defined, multi-use areas with a zoning system and aimed at achieving biodiversity conservation (for MoEF and MMAF-managed MPAs) and sustainable fisheries (for MMAF-managed MPAs) to support human welfare (Law No. 27/2007; Law No.5/1990). Many elements of Indonesian MPAs align with the International Union for Conservation of Nature (IUCN)'s MPA definition [25], with the most significant exception being that formally recognized MPAs in Indonesia are governed and managed by government agencies, either alone or in some form of co-management. By 2020 Indonesia had successfully achieved its decadal national marine conservation target through the designation of 201 MPAs with a total area of 24.1 million ha [26]. Until now, MPAs have been the only approach considered by the state for measuring national achievements in marine conservation, including when reporting Indonesia's contribution to CBD Target 11 and Sustainable Development Goal 14.

Government-led MPAs are not the only approach that contributes to marine conservation in Indonesia. Communities also actively initiate, are involved in, or implement various area-based management practices that may lead to positive biodiversity outcomes. Examples include customary management (*sasi*) in eastern Indonesia (e.g., [27]), LMMAs across Indonesia (e.g., [28]), managed access with reserves in Southeast Sulawesi (e.g., [29]), or private sector-led restoration of degraded reefs in South Sulawesi (e.g., [30]). Such practices may not have conservation as their primary management objective but may contribute to biodiversity conservation. Although their outcomes are currently not

reported by the state as a contribution to the nation's marine conservation achievements, sites under these types of management have the potential to meet the OECM criteria agreed by the CBD. Having diverse existing practices, of which many have been implemented for centuries with high compliance, Indonesia is in a good position to recognize and integrate OECMs into the national policy framework.

Following the positive trajectory of MPA establishment and implementation in the past decade [22,23], the national marine conservation target has been increased to 32.5 million hectares (or ~10% of Indonesian archipelagic waters) of conserved marine areas by 2030 [26]. Expansion of MPAs is still the primary effort pursued by the government, as reflected in the current national midterm development plan 2020–2024 (Presidential Regulation No. 18/2020). Nevertheless, promoting and recognizing other existing forms of area-based marine management, such as OECMs, can become a complementary strategy to conserve biodiversity beyond MPA boundaries and ensure locally appropriate conservation approaches are used.

3. Identification of types and distribution of potential marine OECMs in Indonesia

As of 2021, the Government of Indonesia has neither defined nor adopted OECMs (or literally translated as *tindakan efektif lainnya untuk konservasi berbasis kawasan*) into national and sub-national policy or legislation. Herein, we consider 'potential marine OECMs' to be sites [as area-based practices/approaches/tools/features] that exist in Indonesia and fulfill at least three OECM elements as agreed by CBD, i.e.: (a) not an MPA, (b) governed (i.e., under the authority of a specified entity) and managed (i.e., under a management regime), (c) with a likelihood of contributing to long-term in situ conservation of biodiversity (see [14] for all elements). Because most practices are poorly documented and not monitored regularly, their contribution to biodiversity conservation and social values is largely unknown to scientists. Selecting only a few OECM elements for marine OECM candidate identification allows us to capture a wide range of practices, including those least documented. Whether these actually deliver long-term conservation outcomes will need to be verified.

Indonesia's potential marine OECMs and their distribution were identified through two workshops on area-based marine, coastal, and small island biodiversity management (*lokakarya pengelolaan keanekaragaman hayati laut, pesisir dan pulau-pulau kecil berbasis wilayah*) in Jakarta, Indonesia, held in January and February 2020, and organized by MMAF and Wildlife Conservation Society. These workshops involved 120 participants from government, non-profit organizations, and academia. From the data gathered, we removed duplicates, identified the exact spatial locations (within MPAs, part of MPAs, or outside MPAs), provided additional explanations when necessary, and added new entries based on literature and available information. This study relied heavily on expert knowledge and is not comprehensive. It was intended to be a scoping exercise to begin to identify potential sites and practices that might be considered as OECMs in Indonesia, including their distribution and contribution to conservation. This study provides the first documentation of several potential OECM sites and forms of management that could give rise to long-term conservation outcomes.

3.1. Types of potential marine OECMs

We first identified 14 distinctive area-based management types in Indonesia that could potentially be classified as OECMs after further site-level evaluation (Fig. 1; see detailed explanation in Table A.1). Second, we grouped them into three categories based on governance type by: (i) government, (ii) community/customary including Indigenous Peoples, and (iii) private sector. Third, we classified the types of potential OECMs into three groups based on the level of biodiversity conservation objective, from ancillary (i.e., biodiversity outcomes as by-products), secondary (i.e., biodiversity outcomes as a secondary management objective), to primary (i.e., biodiversity outcomes as the primary management objective, but is not able to be recognized as an MPA under existing Indonesian laws). These classifications resulted in nine combinations based on governance entities and level of desire to conserve biodiversity (Fig. 1; Table A.1). Finally, to understand the diversity of management objectives of the 14 potential OECMs types, we assigned each type into one of five categories based on the governance entities, i.e., managed by customary communities: traditional (*Td*, the area can be used for various purposes and is governed by customary, cultural or religious regulations), and managed by the government, local communities or private sectors: protection (*P*, to protect or conserve an area or particular biota), fisheries (*F*, to use an area for fisheries activities), tourism (*T*, to use an area for tourism activities), and others (*O*, to use an area for other purposes).

Overall, the types of potential marine OECMs in Indonesia are very diverse (Fig. 1). Protection and fisheries were the dominant purposes of most identified potential marine OECMs. Potential OECMs focused on biodiversity protection mainly were associated with primary or secondary biodiversity conservation objectives, while those with fisheries purposes were mostly associated with secondary biodiversity conservation objectives. Other purposes of use mostly contained areas that had ancillary biodiversity conservation objectives. In contrast, traditional areas and tourism areas cross-cut all three levels of biodiversity conservation objectives (i.e., ancillary, secondary, and primary), suggesting that traditional areas and tourism can encompass many different approaches and purposes.

There is some overlap that occurred among the OECM types, for example, community-led/customary managed areas may include historic features/monuments, or the outermost small island management can be included within the national strategic area management. Some identified OECM types may qualify under the IUCN-MPA framework (e.g., locally managed areas, private/local conservation areas) but are not recognized as MPAs in Indonesia because they have different management frameworks or are governed by non-state actors. Fisheries management areas (FMAs, *wilayah pengelolaan perikanan*) and national strategic areas cover very large marine areas including provincial/district waters and national water and may contain MPAs and other smaller sizes of area-based management types. We included both types in this study because they have been formally recognized by the state as area-based management tools, although their recognition as OECMs in Indonesia needs further discussion. We also included types that may not qualify as OECMs according to the CBD criteria, mainly related to single-species conservation, temporary closures, rehabilitation activities without evidence of long-term success, or extractive activities. The inclusion of these types is driven by authors' experience seeing some successful case studies, and these may need to be carefully considered when the government designs the OECM framework in the future. Therefore, the identified types are not meant to be all-encompassing, but they indicate the diversity of OECM candidates that exist in Indonesia.

We intentionally grouped all customary-based management as 'traditional' because different regulations applied to these practices (see Section 4.2) and they have a high diversity of practices, for which details are not available due to limited published information. This implies that when practiced locally, OECMs in the traditional (Td) category can have management purposes similar to other potential marine OECM types, i.e., protection, fisheries, tourism, or others, but are differentiated by being managed under customary, cultural, or religious rules. Customary managed areas comprise a wide range of management measures with regards to: (a) protection (e.g., full/temporal/rotational closure), (b) allowed uses (e.g., banned fishing for specific biota or fishing gears), (c) resource users (e.g., applied for specific groups or the entire community), or (d) sanctions for violation (e.g., fine, social punishment). With a wide local variety of customary managed areas and limited documentation available, differentiating specific management purposes for each practice is often impossible. Individual customary practices may be assigned to two OECM types (e.g., *sasi* can have conservation as a

To achieve *in situ* biodiversity conservation

Low desire to conserve biodiversity → ***High desire to conserve biodiversity***

Biodiversity conservation objective	Ancillary	Secondary	Primary
Government Regulated Managed Areas *These are sites or expanses of marine areas that have some form of specific marine management regulation stipulated by the government authority*	- Military sites ***(O)*** - Airport runways/areas in coastal areas ***(O)*** - Outermost islands ***(O)***	- Fisheries Management Areas ***(F)*** - Temporary fishing closure areas* (e.g., FMA 714 temporary fishing closure for yellowfin tuna) ***(F)*** - Restored areas using artificial structures to support fisheries* (e.g., "fish apartment") ***(F & P)*** - Restored areas through natural replantation to support fisheries* ***(F & P)*** - National Strategic Areas ***(O)*** - Marine tourism villages (e.g., *Dewi Bahari*) ***(T)*** Historical features or monuments ***(Td)***	- Formal managed areas for conservation^ (e.g., world heritage, man and the biosphere, mangrove center) ***(P)*** - Coral reef/mangrove rehabilitation areas* ***(P)***
Community/Customary Managed Areas *These are areas designated by the community / village level agreement. These may sometimes be supported by formal village regulation (PerDes), and in some cases further authorized by District regulation (PerDa) and Provincial regulation*	- Marine tenure areas ***(Td)***	- Customary/traditional managed areas* (e.g., *meti* areas, *Sasi, Lilifuk, Awig-awig, Panglima Laot*) ***(Td)*** - Managed Access and Reserve ***(F & P)*** - Restored areas through natural replantation to support fisheries* (e.g., mangrove forestry for mud crab fisheries) ***(F)*** - Marine tourism villages (e.g., *Dewi Bahari*) ***(T)*** - Historical features or monuments ***(Td)***	- Customary/traditional managed areas (e.g., sacred sites, taboo/*pamali* sites) ***(Td)*** - Comunity-based or Locally managed marine areas^ (e.g. LMMAs, village conservation areas) ***(P)*** - Coral reef/mangrove rehabilitation areas* ***(P)***
Private Sector Managed Areas *These are areas where some form of agreement exists with a private sector partner for the management of the area. This category includes areas managed by individuals*	- Area/land leased for resort/tourism ***(T)*** - Oil and gas platforms* ***(O)***	- Privately managed tourism areas (e.g., private resort) ***(T)*** - Restored areas using artificial structures as part of CSR or for tourism* ***(T & P)*** - Restored areas through natural replantation as part of CSR or for tourism* ***(T & P)*** - Private-led aquaculture areas* ***(F)***	- Privately managed areas for conservation^ (e.g., Misool no-take areas) ***(P)*** - Restored areas using artificial structures for conservation* ***(P)*** - Restored areas through natural replantation for conservation* ***(P)***

Note: * These types may not qualify as an OECM following the IUCN criteria, however Indonesian experts decided to include them in this study as there have been observed successes in achieving biodiversity outcomes.
^ These types meet the IUCN-MPA definition but are not recognized as MPAs in Indonesia because they have a different management framework or are governed by non-state stakeholders.

Fig. 1. Types of potential marine OECMs in Indonesia. Information in brackets describes the primary management purpose of each type: Td - *traditional* (the area can be used for various purposes and is governed by customary, cultural, or religious regulations), P - *protection* (to protect or conserve an area or particular biota, F - *fisheries* (to use an area for fisheries activities), T - *tourism* (to use an area for tourism activities), and O - *others* (to use an area for other purposes).

primary or secondary objective) because they can be implemented in different ways among communities. We also observed that some practices could have a wide range of names, for example, customary managed areas for fisheries are known as *panglima laôt* in Aceh, *lilifuk* in Kupang, or *manam'mi* in Talaud Island, and commonly are determined by local languages, beliefs, and cultures.

3.2. Distribution of potential marine OECMs

We identified 704 sites, of which 397 are located outside MPAs and thus constitute potential marine OECMs (Figs. 2a, 2b, Table A.2). The potential marine OECM distribution varied markedly across Indonesia (Fig. 2a), with 46.1% having *traditional* as the primary management purpose, followed by 18.1% for *other purposes*, 15.6% for *fisheries*, 12.4% for *protection*, and 7.8% for *tourism* (Table A.2). These potential marine OECMs are managed by customary communities (46.1%), government (31.5%), private sector (12.1%), or local communities (10.3%) (Fig. 2b, Table A.2). The size of the 83 potential OECM sites with area information ranged from < 1 ha to ~67,000 ha (Table A.2). Based on this exercise, customary managed areas are the most abundant and widespread potential OECMs; however most sites and practices within this category do not have clear boundaries or boundaries not formally recorded and documented. Their boundaries are commonly marked by natural signs (e.g., trees, cliffs, water depths), which are usually well-known by the communities applying the practice (see examples in [31]). We observed that some management practices (e.g., *sasi*, community-based conservation areas, areas leased for private sector/individuals) are only listed from one or a few locations. In reality, these practices can be found in other areas but these other sites are not listed in this study due to the limited information available. Furthermore, two potential OECM types mentioned in Fig. 1 (i.e., oil and gas platforms and military sites) did not have accessible spatial data or workshop participants could not identify the exact locations, therefore not included in Figs. 2a and 2b. It is important to note that these numbers reflect the practices and sites

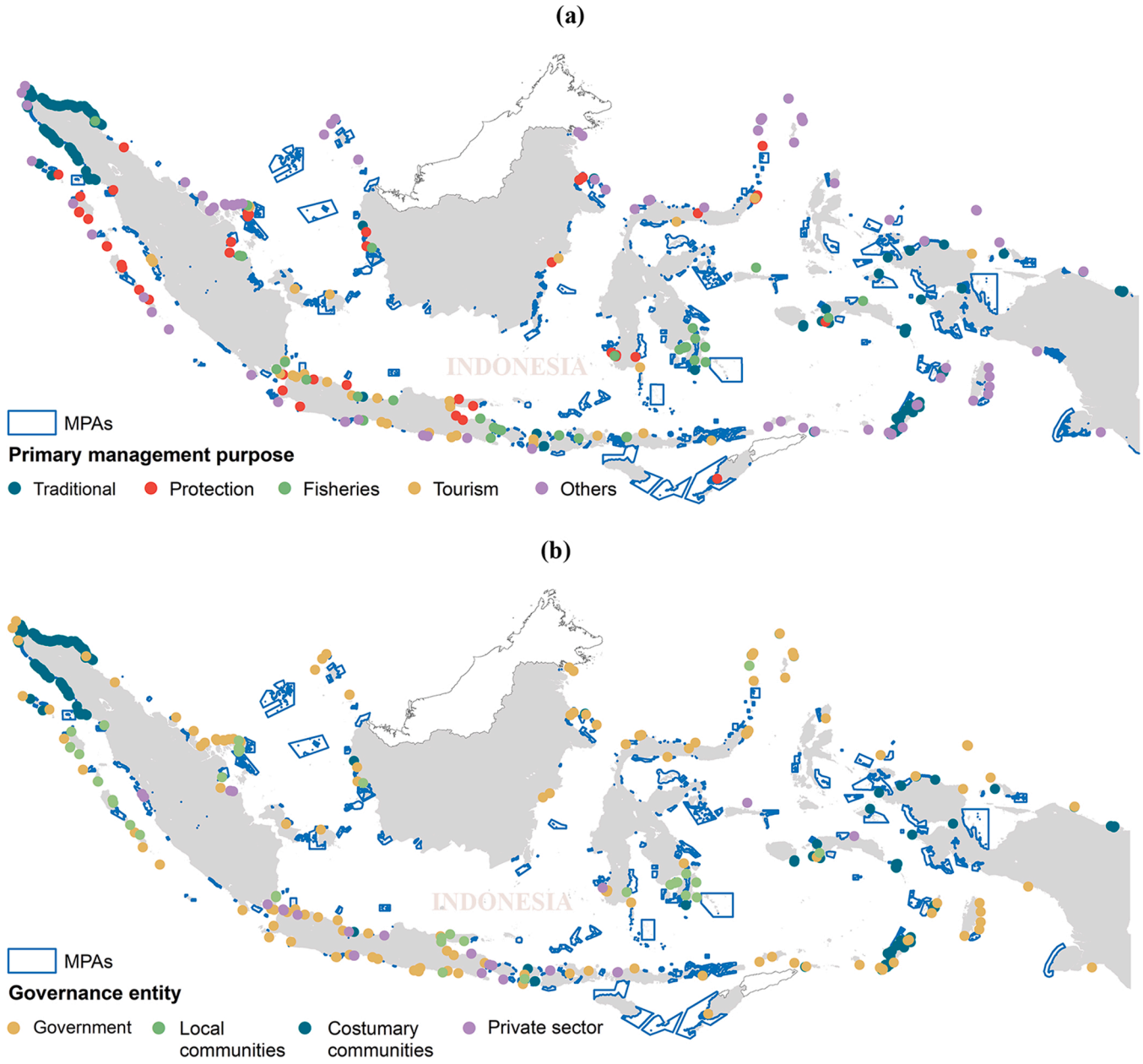

Fig. 2. Distribution of potential marine OECMs in Indonesia, based on (a) primary management purpose and (b) governance entity. Locations of existing MPAs (as of 2020) are shown for comparison.

Table 1
Examples of potential marine OECM contributions to the environment and society.

Name of practice, location	Primary/ secondary biodiversity objective	Description
Government-led management areas		
Temporary fishing closure in Fisheries Management Area (FMA) 714, Banda Sea, Maluku	Secondary	Through MMAF Minister Regulation No. 4/2015, the Indonesian government regulates temporary and partial closure of marine areas (approximately 130,000 km^2) for yellowfin tuna (*Thunnus albacares*) fishing from October to December. After implementing this regulation, within a year, fishers' income per capita in 2015 increased by 1.46%; there was no social impact on fishers as an effect of this new regulation, and the potential catch for yellowfin tuna remained stable [32].
Community-led or customary management areas		
Customary *panglima laôt* or 'sea commander', Aceh	Secondary	Aceh waters are divided into 176 '*lhoks'*, and each is governed under the *panglima laôt* system. The rules for these areas mainly support fisheries; for example, who is entitled to a catch sighted at sea and enforce protection of the coastal environment. *Lhoks* in Weh Island showed an increase in coral cover and enhanced fish abundance between 2013 and 2019 [33]. In contrast, Apriani [34] in 2016 reported that while fishers in *lhok* Banda Aceh complied with the rules, they had low awareness of conservation issues.
Customary *sasi*, Maluku and Papua	Secondary	*Sasi* is a centuries-old community-based set of practices regulating access to natural resources [35], for example by implementing fisheries closures that last roughly two to five years [36]. Marine *sasi* is governed by the associated customary community with rules on what, when, and where to fish. The results from *sasi* implementation are mixed across settlements, including increased economic income in Tanimbar Island, Maluku and Raja Ampat, Papua [37,38]; enhanced fish stock in Ugar Island, Papua Barat [39]; and increasing [38] or declining [40,41] total harvests in several villages in Maluku and Papua.
Customary *mane'e,* Kokoropitan Island, Sulawesi Utara	Secondary	*Mane'e* is part of a customary law process called Eha', a warning against taking natural resources during a particular time. It is implemented with the concept of protecting marine ecosystems and natural resources from overexploitation, though catches have been declining recently, likely due to environmental degradation [42].
Village-level marine protected areas	Primary	After the government of Indonesia launched the Coral Reef Rehabilitation and Management Program (COREMAP) in 1998, the government facilitated the development and implementation of > 300 village-level marine protected areas (*daerah perlindungan laut*/DPL) covering a total marine area of 15,795 ha across Indonesia from 2004 to 2011 [43,44]. The DPLs were managed by local communities but were initiated and supported by the government. DPLs were claimed to increase communities' awareness of marine conservation issues, reduce destructive fishing activities, and improve coral covers. Many DPL areas have now been transformed or included into provincial/national MPAs.
Community-led temporary fishery closures for mud crab, Kubu Raya, Kalimantan Barat	Secondary	Four villages in Kubu Raya managed their mud crab fisheries and protected their forest through temporary fishery closures (~3 months per year) across 6,519 ha of mangroves [45]. Within three years, specifically in Sungai Nibung village, the community had experienced an improvement in coastal fishery harvest rates which led to an increase in income, health, and education, while a reduction in mangrove forest loss was also observed [46].
Community-led mangrove rehabilitation, Sinjai, Sulawesi Selatan	Primary	In 1985, ten local communities from Tongke-tongke village initiated mangrove rehabilitation in degraded mangrove areas to protect shorelines from severe abrasion. The initiative is ongoing and has been replicated by many local communities from other villages. By 1995, it was estimated that communities had rehabilitated more than 450 ha mangroves from Tongke-tongke and Samatarring villages alone [47]. This initiative has contributed 25.7% (2017) and 69.4% (2018) to Sinjai district's annual tourism revenue from tourist retributions to enter the mangrove rehabilitation areas [48]. Unfortunately, after the newly accreted land from rehabilitated mangrove areas was claimed as the state's property, the communities have limited access to make any further use of the areas [49].
Private-led management areas		
Misool no-take areas, Papua Barat	Primary	A resort company established two no-take zones (NTZs) through direct leasing from local villages. The NTZs are now part of Misool Marine Reserve, which is nearly twice the size of Singapore. Within six years (2007–2013), fish biomass increased by 250%, and shark and manta populations inside the reserve increased to 25 times those outside the reserve [50].
Reef restoration, Pemuteran, Bali	Primary	Reef restoration using mineral accretion technology has been conducted since 2000 with the support of a resort in Bali to restore reefs degraded due to destructive fishing and elevated sea surface temperatures. The project has brought several positive outcomes, such as improved coral cover, a five-fold increase in diving activities in reef restoration sites, a decrease in unemployment numbers by 85% (2010–2015) due to increased tourism activities, and more substantial involvement of the local community in reef restoration activities [51].

known to workshop participants and authors, which may be biased towards where they work and live. This also infers that the actual number of potential marine OECMs may be much higher than that identified in this exercise. Although there were pieces of evidence that some potential marine OECMs have been actively implemented for generations (see Table A.2), unfortunately this exercise could not specify whether each potential marine OECM was still active/inactive due to inaccessible and unavailability of data at the village/local level.

3.3. Conservation effectiveness of potential marine OECMs

While we were able to gather much information on potential marine OECMs and their distribution, the question remains whether these sites and practices can contribute to long-term biodiversity conservation and social values. Addressing this question is challenging because most of these potential OECMs are not documented or monitored regularly. This means there is limited scientific evidence that the sites and practices could provide, or have provided, long-term positive or negative outcomes for the environment and society. Our search in the published literature resulted in limited information compared to the total identified potential marine OECMs in Indonesia, and some examples are shown in Table 1 (see Table A.2 for other examples).

We found that potential marine OECMs, especially well-studied ones, have diverse outcomes. For environmental outcomes, coral cover, fish abundance/biomass, and fish catch are the most common metrics used. Meanwhile, community participation, economic benefits, and conflicts

are often mentioned as social outcomes in the literature. Most practices have had positive outcomes, but a few practices in one or more specific area(s) did not, or could not, contribute to conservation or social values. A decline in fish catch, for example, was reported within the *mane'e* area in Kokoropitan Island [42]. Compliance with rules for most customary-led management is relatively high, mainly because these practices entail strongly held or locally important beliefs and norms [38,52]. Economic interests influenced the conservation effectiveness of some practices. For example, *sasi* in Selaru Island is sometimes opened when a village needs to build infrastructure or a community has urgent economic needs [53]. Community involvement in a reef restoration project in Bali has increased since the project began to yield income for the community through tourism [51].

From our literature review, it is clear that much attention has been paid to the history or management of the potential marine OECMs, rather than the long-term effectiveness and outcomes of the practices. When there is literature discussing the two latter topics, the information given is very diverse, patchy, and often short-term and qualitative, ranging from information on the coral cover to unemployment rates, total harvest volume, or social conflicts, as there is no standard metric to measure outcomes. Although examples in Table 1 provide interesting case studies, given that they represent a wide range of potential marine OECMs, they cannot be used to generalize the overall outcomes of marine OECMs in Indonesia. These challenges clearly highlight a need for participatory research into these issues.

4. Recognition of OECMs for marine area-based conservation in Indonesia

4.1. Why does it matter?

Following the dramatic increase of threats to marine resources due to anthropogenic activities and climate change in Indonesia, conservation plays a vital role in reducing environmental impacts and maintaining biodiversity [19]. MPAs, as a primary conservation tool implemented by the state, have provided area-based protection to coastal ecosystems in the last few decades [22,23]. MPA implementation across Indonesia has had mixed progress and results, with some successes but also many MPAs making slow progress. The outcomes are strongly influenced by the management capacity, local participation, and regulation changes (see [54–58]). Indeed, implementing MPAs requires significant resources and continuous effort (e.g., staff capacity, funding, management plan, regular monitoring and evaluation) with a risk of low performance when there are shortfalls or lack of continuity in these resources [59]. In addition, active local community participation in every process also drives the success (or failure) of MPA implementation [60,61].

While Indonesia has successfully achieved its area-based marine conservation targets for 2020, these MPAs cover less than 8% of the nation's archipelagic waters [22,23], meaning that 92% of Indonesia's seas require other resource management measures to protect their biodiversity and sustain marine resource productivity. To increase area under protection, the state has set a new target to expand MPAs to cover 10% of the nation's archipelagic waters by 2030 [26]. Expanding MPAs further, especially for future targets beyond 2030, may have context-specific benefits. But equally, it may be impractical in other places for several reasons: (a) increased potential spatial conflicts with other marine resource users, mainly because MPAs are located mostly nearshore (<12 nautical miles/nm) where the majority of marine resource uses occur; (b) it is technically challenging and resource-consuming to establish MPAs in offshore areas which are considered more than 12 nm from shore, and therefore beyond the jurisdiction of provincial governments; and (c) limited resources available to implement a large number of MPAs. In this regard, diversifying area-based conservation tools is promising because this can potentially increase compliance and be resource-effective.

The findings in Section 3 show that Indonesia has a diverse range of area-based management practices besides MPAs that potentially provide positive outcomes for biodiversity. There are some cases where communities and stakeholders wanted their sites to be included in or designated as an MPA, aiming to increase the legitimacy and security of their sites. For example, *panglima laôt* in Sabang, Aceh [33,62] and *papadak/hoholok* in Rote Ndao, Nusa Tenggara Timur [63] were included as customary/traditional utilization zones within Sabang MPA and Laut Savu MPA, respectively. Our identification in Section 3 and Table A.2 also reveals that almost 44% (307) of potential marine OECMs identified have been included within or as part of MPAs, which means many sites that initially had some form of area-based management have been transformed into formal protected areas. However, there are several cases of local communities rejecting plans for their area-based management to be transformed by the designation of an MPA, primarily driven by distrust of the government's MPA system, fear that government will take their right and flexibility to use marine resources [28,64–66], complicated formal recognition processes [66], or incompatibility of an MPA framework with local practices [61]. When this happens, customary communities have a legal option to formally register their group, practices, and managed areas as a 'customary law community' (*masyarakat hukum adat*) and continue their traditional practices without much intervention from outside stakeholders and users. In contrast, there is no legal mechanism to acknowledge sites and practices that may contribute to conservation led by other entities (i.e., traditional/local communities and the private sector). When designating an MPA is not appropriate, identifying such sites and practices as OECMs may be beneficial, subject to local consent.

With the global push to recognize and support OECMs to promote biodiversity conservation, OECM recognition in Indonesia will help increase stakeholder participation and contributions to protecting the country's marine biodiversity and achieving national and international targets for area-based conservation. Furthermore, the OECM framework could enhance synergy between formal and informal frameworks [8] so that diverse actors could contribute directly to area-based conservation and receive incentives when they are successful. OECMs also have considerable potential to advance effective, inclusive, and equitable conservation by empowering customary and traditional communities, government, and other stakeholders to collaborate and actively participate in marine management and conservation under a co-management framework [11,67]. Lastly, OECMs provide an interesting opportunity to improve conservation effectiveness by reducing social conflict [68], filling management capacity gaps (e.g., funding, enforcement) to implement sustainable management [69], building higher resilience to social, cultural and economic changes into local communities dependent on marine resources [69], and revitalizing/strengthening some weakening customary practices (see examples in [31]). Based on these considerations, as Indonesia deliberates the use of OECMs, the country can take advantage of having diverse forms of existing area-based management, especially traditional forms of marine management that have existed for centuries.

4.2. Relevant laws and regulations

While OECMs have been promoted by the CBD since 2010, to date Indonesia does not have specific policies on OECMs. However, many existing laws can be interpreted to support the essence of the OECM framework (Table 2). To preface this analysis, it is essential to note that the state controls all natural resources (1945 Indonesian Constitution, Article 33.3), meaning that the government owns the rights to regulate, manage, use, and conserve natural resources and decide who can use the resources for the people's welfare. The state implements area-based management by allocating terrestrial/marine areas for specific purposes (e.g., forestry, fisheries, settlement, agriculture) and formalizes these zones in the district or municipality, provincial, and national spatial plan documents (Government Regulation/GR No. 21/2021). These zoned areas can be used for profit, non-profit, or nationally

Table 2
List of laws and regulations related to area-based marine management that can encompass elements of the definition of an OECM, based on the hierarchical legal order.

Regulations	Description
Constitution	
The 1945 Constitution of the Republic of Indonesia	Article 18B.2 - The State recognizes and respects traditional communities along with their traditional customary rights as long as these remain in existence and are in accordance with the societal development and the principles of the Unitary State of the Republic of Indonesia, and they shall be regulated by law. Article 33.3 - The land, waters, and natural resources within shall be under the jurisdiction of the state and shall be used to the greatest benefit of the people.
Law	
Law No. 5/1960 on Basic Agrarian Principles	Governs the principles and provisions of the control, ownership, use, and utilization of national agrarian resources in Indonesia. This law provides a legal basis for the ownership or utilization of customary lands or marine territories by customary groups.
Law No. 5/1990 on Conservation of Biodiversity and Ecosystems	Specifies the scope of natural resource conservation: biodiversity and ecosystem protection, preservation, and sustainable use. The state has the right to decide conservation areas, types of protection through establishing protected areas, and allowed uses within an area.
Law No. 31/2004 *juncto* Law No. 45/2009 on Fisheries *juncto* Law No. 11/2020 on Job Creation	Regulates fisheries management in marine areas and freshwaters, including developing, managing, and deciding fisheries management plans, allowable catch, fishing gears, fishing grounds, fish sales, and fisheries resource protection. The state uses an area-based management system to manage fisheries by dividing Indonesian marine waters into 11 Fisheries Management Areas (FMAs; *Wilayah Pengelolaan Perikanan*). Small-scale fishers with boats less than 5 GT are excluded from permit obligation and can fish in all national waters.
Law No. 27/2007 *juncto* Law No. 1/2014 on Management of Coastal Areas and Small Islands *juncto* Law No. 11/2020 on Job Creation	Regulates all marine resource use from shorelines to 12 nautical miles. The management of coastal areas and small islands includes planning, utilization, supervision, and control of marine resource uses. The regulation specifies an area-based marine management system used by the government through spatial zone planning and procedures for using marine resources. Communities, corporations, and individuals should obtain utilization permits to use specific marine areas for specific uses. This permit does not apply to customary law communities and governments. Customary law communities can use marine areas responsibly if the state has acknowledged their presence and their customary managed areas have been included in the zoning plans. Meanwhile, the government can use marine areas that have been allocated in spatial plan documents after receiving confirmation of marine spatial suitability (*konfirmasi kesesuaian ruang laut*). Under this regulation, marine areas primarily allocated for conservation will be designated as Marine Protected Areas.
Law No. 32/2009 on Environmental Protection and Management *juncto* Law No. 11/2020 on Job Creation	Specifies the procedures for planning, utilizing, controlling, maintaining, and enforcing environmental protection and management in all development sectors. The regulation requires those carrying out resource uses/activities that may create significant environmental impacts to conduct environmental impact assessments (*analisis dampak lingkungan/AMDAL*). Activities with no or less significant environmental impacts should meet the environmental standards as stipulated in UKL-UPL (*upaya pengelolaan lingkungan–upaya pemantauan lingkungan*/environmental management efforts-environmental monitoring efforts) and are not required to conduct an AMDAL. To ensure diverse actors implement the environmental standards, the government mandates regular environmental audits, especially for activities with significant impacts on the environment.
Law No. 32/2014 on Marine Affairs *juncto* Law No. 11/202 on Job Creation	Regulates Indonesia's marine areas and their use within territorial waters extending to the boundary with the high seas and international waters for marine development, management, protection, and governance. Like in Law No. 27/2014, non-state communities, except customary law communities, can use marine areas through utilization permits.
Government Regulation (GR)	
GR No. 5/2021 on the Implementation of Risk-Based Utilization Permits	Regulates the issuance and management of utilization permits for all development sectors. Business licensing requirements are determined based on the level of business risk, such as level of human and environmental risk and food safety. Specifically for the marine and fisheries sector, utilization permits are issued for activities related to marine spatial management (includes tourism, salt production, biotechnology, reclamation, etc.), capture fisheries, fish transportation, aquaculture, fish processing, and fish marketing.
GR No. 21/2021 on Spatial Management	Regulates spatial management for terrestrial areas, marine areas, and airspace areas.
GR No. 46/2017 on Environmental Economic Instruments	Specifies the environmental economic instruments used by the state, i.e., development and economic activity plans, environmental funds, and their management body, and incentives/disincentives.
Ministerial Regulation (MR)	
MMAF MR No. 8/PERMEN-KP/2018 on the Procedures for Recognizing the Management Areas for Customary Law Communities within Coastal and Small Islands Spatial Plans	Specifies the procedures to propose the management areas of customary law communities and the processes to recognize and protect the customary law communities.

strategic purposes. Under the regional autonomy policy (Law No. 23/2014 *juncto* Law No. 11/2020), each governmental level (district/city, province, national) must implement the agreed spatial plans within its jurisdiction.

While the state controls all natural resources, local communities, commercial entities, and stakeholders can have the right to use and manage an area through licensing mechanisms. Specifically for marine areas, there are three distinctive formal ways to obtain legal use rights, differentiated by the users. First, customary law communities (*masyarakat hukum adat*, i.e., communities who have lived within a coastal area and have used and managed the marine resources for generations under customary rules) can own the right to use and manage marine areas when the government has formally acknowledged their presence, and the customary managed areas have been included in spatial plan documents called *rencana zonasi wilayah pesisir dan pulau-pulau kecil*/RZWP-3-K (Law No. 27/2007 *juncto* Law No. 1/2014 *juncto* Law No. 11/2020). Second, traditional communities (*masyarakat tradisional*, i.e., communities who have traditional fishing rights in a

particular area) and local communities (*masyarakat lokal*, i.e., communities who live within a coastal area and may or may not depend on marine resources) will be facilitated by the government to obtain formal approval for spatial use suitability *(kesesuaian kegiatan pemanfaatan ruang*, GR No. 21/2021). These communities may use coastal and marine areas for capture fisheries, aquaculture, salt farming, marine tourism, or floating settlements to fulfill their daily needs. Third, other resource users, including individuals or corporates, as enacted by new regulations (Law No. 11/2020 and GR No. 5/2021), need to obtain a utilization permit *(perizinan berusaha)* from the government in order to use a marine area for a certain period and for specific use(s) allocated for that area. These licensing mechanisms allow diverse actors, both state and non-state communities, to use and manage specific marine areas regardless of the purpose, and this represents three criteria of OECMs, i.e., geographically defined areas, governed, and managed.

Our exploration of related key policies and regulations (Table 2) indicates that marine resource uses should align with nature conservation and social-economic-cultural principles. For instance, utilization permits can be issued or extended if the entity requesting the permit provides evidence that the activities will not, or did not, harm the environment and cause negative impacts on communities. As mandated by the regulations, a dedicated group that involves representatives from the government, community, and resource users should monitor and evaluate the permitted marine resource use independently. The state also requires private companies or individuals who use resources with a high risk of impacts on the environment (e.g., mining, intensive aquaculture) to conduct regular environmental impact assessments *(analisis dampak lingkungan/AMDAL)* as a requirement to obtain or extend utilization permits.

Although biodiversity and social values are included in all relevant regulations as guiding principles for using marine areas sustainably, our findings show there is no mechanism to recognize an area as an OECM if it positively impacts biodiversity and human well-being. The closest mechanism available is the use of environmental economic instruments to provide incentives and environmental funding for activities that could contribute, or disincentives for those that failed to contribute, to nature protection and management (GR No. 46/2017). The benefits from such actions can be given to communities, private companies, or district/provincial governments. They can come in various forms ranging from a direct grant from the government, ease in getting permits, to infrastructure support. Introduced in 2009 and formalized in 2017, the environmental economic instruments have not been yet implemented to encourage practices to improve biodiversity benefits and support long-term conservation [70]. There is another mechanism that has been implemented by the MoEF since 1995, i.e., PROPER (*program penilaian peringkat kinerja perusahaan dalam pengelolaan lingkungan)*. This is a scheme for rating company performance in environmental management, to encourage companies to take an innovative approach in protecting biodiversity around their areas of operation. While PROPER has a set of standard indicators for rating a company's performance, the environmental economic instruments do not have specific indicators for determining the success of community measures in contributing to marine biodiversity and their eligibility for incentives. OECMs provide an opportunity to address those challenges through the selection criteria and performance evaluation. With a regulation update, the instruments can recognize area-based management practices that positively impact biodiversity and society as OECMs.

4.3. What do we need to consider when adopting OECMs in Indonesia?

Our study highlights the numerous and diverse potential marine OECMs in Indonesia and provides an initial exploration into the opportunity for more formal recognition of OECMs. It is important to note that these potential OECMs provide varying contribution levels to conservation. Therefore, setting a target to have as many OECM sites or areas as possible may not be appropriate for Indonesia. Instead, more effort should be directed towards the recognition and management of existing potential OECMs, especially to document and report the practices and conservation outcomes and sustain their management long-term, thereby qualifying them for recognition as OECMs, subject to the rights of the respective governance authorities [18]. As such, for OECMs to meaningfully contribute to conservation, transformational strategies are required when recognizing and supporting OECMs. Here, we identify four key strategies that can be implemented: (i) safeguard customary and traditional communities, (ii) leverage cross-sector and cross-scale collaboration, (iii) focus on delivering outcomes, and (iv) streamline legal frameworks.

First, safeguarding coastal customary and traditional communities is critical for the 40 million people who live in Indonesia's coastal areas [71], many of whom are highly dependent on marine resources [20]. We need to ensure the management of OECMs by diverse actors will not undermine existing customary management by taking away rights from customary/traditional authorities, removing flexibilities in managing their areas (e.g., [49]), or creating other adverse effects on communities (e.g., [72]). Moreover, the state needs to ensure these communities are not disenfranchised, particularly by private sector initiatives. The issuance of Law No. 11/2020, which was intended to increase the investment and economic activities for all development sectors, including marine resources-based industries, has been widely criticized because it seems the government provides a fast and easy track for the private sector to obtain utilization permits for natural (marine) resource use [73]. As this law was recently issued, there is currently no evidence of whether this claim is valid or not. Nonetheless, the state needs to ensure the implementation of utilization permits should not lead to the parceling of coastal areas for private ownership, as occurred previously in the implementation of coastal waters commercial use rights (*hak pengusahaan perairan pesisir*/HP-3) from 2007 to 2014 (see [74]), and to the exclusion of people from conserved areas (see [75–78] for global examples).

Second, OECMs should leverage collaboration across sectors, among governments, stakeholders, and communities to manage an area without excluding groups or individuals that have ownership rights in those same places. This requires a strong willingness to share benefits among different stakeholders. An example can be drawn from Tongke-tongke in Sulawesi Selatan, where a successful community-based mangrove rehabilitation project has increased tourism in the area. This happened after collaboration among local communities, government, and the private sector to promote mangrove tourism was strengthened by building necessary tourism infrastructure and services and increasing the capacity of local stakeholders [79]. Such collaboration can provide management capacity and sustainable funding and promote compliance and equity in conservation [67]. State support is necessary to enhance institutional durability primarily to facilitate co-management and provide institutional support [80]. Supporting co-management also requires long-term commitment and support from the government and relevant stakeholders to facilitate collaboration across sectors, between levels, and at multiple scales.

Third, a focus on delivering outcomes requires a paradigm shift from achieving area-based targets to achieving biodiversity and social outcomes by strengthening and supporting existing management practices. The government should refrain from creating or recognizing OECMs to meet targets if they do not meet the criteria, are rejected by the governance authority, initiate counterproductive outcomes, or are used as a gap fill to achieve national conservation targets. Efforts to identify/document existing local practices and improve effectiveness should be prioritized over designating new OECMs. By doing so, Indonesia can significantly contribute to effective management and biodiversity conservation, outcomes that have failed to be achieved globally for the 2020 CBD Aichi Target 11 [12]. It is also essential to consider how definitions of area-based conservation measures will impact progress towards targets and real positive biodiversity, social and economic outcomes. Monitoring the effectiveness of OECMs in contributing to biodiversity

can be a challenge, especially for OECMs that are led by communities with limited resources and capacity. Standard, yet flexible, monitoring metrics that can be tailored with the available resources are indeed necessary. This is especially important to avoid overclaiming biodiversity and social outcomes [81], considering most existing potential marine OECMs are led by communities and not regularly monitored and documented using standard metrics.

Lastly, streamlining the legal framework covers multiple components, from developing or revising laws and regulations to accommodate OECMs to ensuring OECM implementation on the ground is formally and legally recognized, doable and effective. While the currently available policies have touched upon several OECM elements, these elements are embedded in several regulations, and there are no mechanisms for recognizing OECMs and acknowledging OECM contributions to nature conservation and human well-being. This highlights the necessity for policymakers and stakeholders to facilitate inclusive processes to consider the best approaches to include the OECM framework and mechanisms in laws and regulations. These mechanisms should include, among others, rights-based considerations, procedures, and metrics to measure OECM contributions to conservation and human well-being, report OECM achievements at national and international levels, and deliver incentives/disincentives, to ensure smooth OECM recognition and management. This process should draw upon lessons learned from implementing MPAs in Indonesia (see [22,55,56]).

5. Conclusions and the way forward

Sustainable area-based management has become a cornerstone to balancing marine resource use and conservation, ensuring that these resources are available and can be used for current and future generations. The implementation of MPAs worldwide to promote conservation is on a positive trajectory. However, implementing MPAs requires enormous efforts [59], and protected areas alone are not enough to halt the more significant threats to (marine) natural resources [82]. The potential for OECMs to play an important and complementary role in promoting biodiversity has been well articulated [11]. For Indonesia, OECMs constitute an immense opportunity to help close the remaining gap in MPA achievements, contribute to the national 2030 conservation target, i.e., 32.5 million ha of conserved areas by 2030, increase the effectiveness and inclusivity of marine conservation, and strengthen co-management among diverse actors. It is important to note, however, given the relatively large amount of effort needed to improve MPA management effectiveness in Indonesia, that recognition of OECMs should not detract from those efforts.

As recognition of OECMs is still in their infancy, there is still much ambiguity to work through to promote the recognition of OECMs. A recent study attempted to outline a path forward recommending five steps to promote OECMs: (1) show that OECMs really work to conserve biodiversity, (2) strengthen local governance, (3) secure funding for recognizing and reporting OECMs, especially for OECMs that are implemented by under-resourced groups, (4) agree on metrics, especially to measure outcomes for both OECMs and protected areas, and (5) include OECMs in other environmental agreements [11]. These recommendations are aimed at the global conservation community; in particular, they are relevant for and can be adopted by Indonesia. In addition, we propose four transformational strategies to inform the OECM recognition process and future development in Indonesia, i.e., safeguard customary and traditional communities, leverage cross-sector and cross-scale collaboration, focus on delivering outcomes, and streamline the legal framework.

Looking forward, several immediate, specific steps can be taken to overcome challenges related to OECMs in Indonesia. The most pressing is to establish a legal framework to acknowledge, manage, and report OECMs. The juxtaposition of customary and traditional community-managed areas within the provincial spatial plans will be beneficial to ensure local communities have priority with respect to the management rights in the areas where they live. Moreover, it is also essential to explore mechanisms that might support the integration of OECMs into national marine area-based targets and how Indonesia contributes to global CBD conservation targets.

CRediT authorship contribution statement

EST, MFA, DSA, SF, and GNA: conceptualization, methodology, data analysis, data interpretation, writing, and revision. IS and MI: data analysis, writing and review. DAA, SJC, MI, HDJ, MEL, HN, FP, NKSP, HCR, TR, IWVS, NRT, and LV: data interpretation and review. All authors contributed to the article and approved the submitted version.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.marpol.2021.104939.

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