

# Integrated Coastal Management (ICM) with a Reference on Protection-production Approach: an Initial Lesson of TWP East Bintan, Kepulauan Riau Province

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**Abstract.** Integrated Coastal Management (ICM) encompasses a holistic marine management strategy that intertwines robust marine ecosystem preservation with sustainable resource utilization. This method aims to harness oceanic resources while advocating for the financial backing of crucial scientific research, sustainable ecosystem management, and support for local fisherfolk and communities, ultimately enhancing the resilience of marine environments. In Indonesia, unlocking the full potential of nature-based solutions for climate mitigation, marine conservation, and sustainable oceanic development necessitates strategic and appropriately scaled investments. Despite being introduced in the 1990s, national-level adoption of the ICM approach remains lacking. Presently, the Government of Indonesia predominantly relies on the establishment of Marine Protected Areas (MPAs) as a primary tool for ocean conservation. With approximately 28.9 million hectares of MPAs currently established, Indonesia plans to expand coverage to 97.5 million hectares by 2045. Aligning with Konservasi Indonesia's Protection and Production approach, MPAs can be tailored to operationalize ICM principles. The East Pulau Bintan MPA serves as a viable case study, demonstrating how zoning strategies can effectively balance marine conservation with sustainable resource exploitation.

## 1 Introduction

Indonesia, the world's largest archipelagic nation is currently the second-largest marine fishery producer, contributing an estimated US \$27 billion annually to national Gross Domestic Product (GDP) and supporting over 12 million jobs [1]. Indonesia's marine fisheries sector also contributes significantly to national food provisioning and subsistence.

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The current national fishery resource potential is estimated to be approximately 12 million tonnes per year (MMAF's Decree No:19/2022), with average annual catches totalling roughly 6.57 million tonnes (roughly 62.5% of total resource potential) in recent years contributing to more than 50% of the national protein intake [2]. Underpinning a large and growing ocean economy are essential marine ecosystems, such as mangroves, seagrasses, and coral reefs. Indonesia has approximately 3.5 million hectares of mangroves (about 23% of the world's mangrove forests), with the highest diversity, containing 92 true mangrove species [3], approximately 13 species of seagrass, and an estimated 39,500 km<sup>2</sup> of reefs, accounting for 16% of the world's coral habitat [4].

However, the sustainability of these marine ecosystems and fisheries resources are under threat, from including overfishing, pollution, climate change, and marine habitat degradation [5,6,7]. As a result, to ensure the sustainability of marine resources and biodiversity from mangrove, seagrass, and coral reef ecosystems, the Government of Indonesia developed area-based conservation as a management strategy.

Marine Protected Areas (MPAs), as an area-based conservation approach, have been recognized as one of the main tools for conserving and maintaining biodiversity and ecosystem services, reducing the negative impacts of anthropogenic activities, and globally playing a role in reducing the rate of degradation of marine life [8,9]. MPAs are built to regulate human activities so that both protection and sustainable production can be achieved. Although the establishment of MPAs is generally aimed at protecting biodiversity [10], MPAs are also recognized as a tool for the management and recovery of commercial fish stocks [11,12]. Moreover, when designed and developed correctly, MPAs can protect marine biodiversity while still supporting the sustainability of coastal community livelihoods [13]. However, to effectively managed marine ecosystems, MPAs are one conservation tool that requires to be combined with other more holistic approaches, such as the Integrated Coastal Management.

As an area-based management system, MPA establishment and monitoring, together with sustainable marine production, could bolster the Integrated Coastal Management (ICM) approach by providing scientifically and community-based designed zonation for different activities. The East Pulau Bintan MPA would serve as a case study on how zoning within the protected area can balance both protection and production. To protect the ecosystem, the core zone, which is a no-take zone, was designated in the area with highest biodiversity levels compared to other parts of the MPA. Beyond protection benefits, we would also explore the economic potential of sustainable tourism that benefits from the core zone including cost-benefit analysis. Zoning within the East Pulau Bintan MPA thus has the potential if we look into MPA management plan, the total allocation budget for activity is around 40,000 \$US for year 2023 but the provincial government only budgeted 2,345 \$US [14].

## **2 Integrated Coastal Management in Indonesia**

In early 1990s, integrated management approach was introduced as a conservation approach. Integrated coastal management constitutes an approach to coastal area management that involves two or more ecosystems, resources and utilization activities in an integrated manner to achieve sustainable coastal area development. In this context, integration includes three dimensions, i.e., sectoral, scientific, and ecological linkages.

In Indonesia, the application of ICM is evident in one of community-based MPAs established in North Sulawesi and Lampung through coastal resources management project on 1997. The implementation in these MPAs focused on capacity building, training, and institutionalization of ICM. However, while valuable to address the urgent need to manage and protect the valuable biodiversity resources that occur along their extensive and diverse coastlines in Indonesia, ICM did not gain widespread traction within the government at the

national level. The holistic approach of ICM remains relevant to managing Indonesia's coastal ecosystem in a sustainable manner. In 2022, Konservasi Indonesia committed to supporting the Indonesian Ministry of Marine Affairs and Fisheries (MMAF)'s MPA 2045 vision of protecting 30% of Indonesian territorial waters by 2045. The support focuses on establishing new MPAs, improving management of the existing MPAs, protecting biodiversity, securing sustainable financing, and assisting Endangered, Threatened and Protected (ETP) species management.

The program intends to contribute to the conservation of Indonesia's biologically diverse marine ecosystem and important fisheries through the creation and improvement of Marine Protected Areas (MPAs) and MPA networks, as well as improved management of commercially and ecologically important fisheries in the project area. MMAF's MPA establishment and management should be integrated into the ICM framework by providing areas for conservation and increased ecological resilience. As a case study, we will share the process of establishing the East Pulau Bintan MPA and initiatives to develop sustainable fisheries management, sustainable marine tourism, and management of blue carbon ecosystems (carbon-rich ecosystems, such as mangroves and seagrass ecosystems) as an example and reference on the application of the protection-production approach to operationalize ICM in support of Indonesia's conservation goals.

### **3 Protection and Production (PnP) Approach**

As the development of conservation approaches continually evolve, the protection-production approach ("PnP approach") can serve as an example or reference for the application of ICM in Indonesia. The PnP approach links effective marine ecosystem protection with sustainable production. The development of ocean resources would be supported by the mobilization of funding for critical science and data, sustainable management of critical ecosystems, and support for small-scale fishers and communities. Further, the PnP design would also be stakeholder-driven and facilitate inclusive local community participation to ensure equity. As a result, the PnP approach would increase the resilience of the marine ecosystems and communities who depend on it.

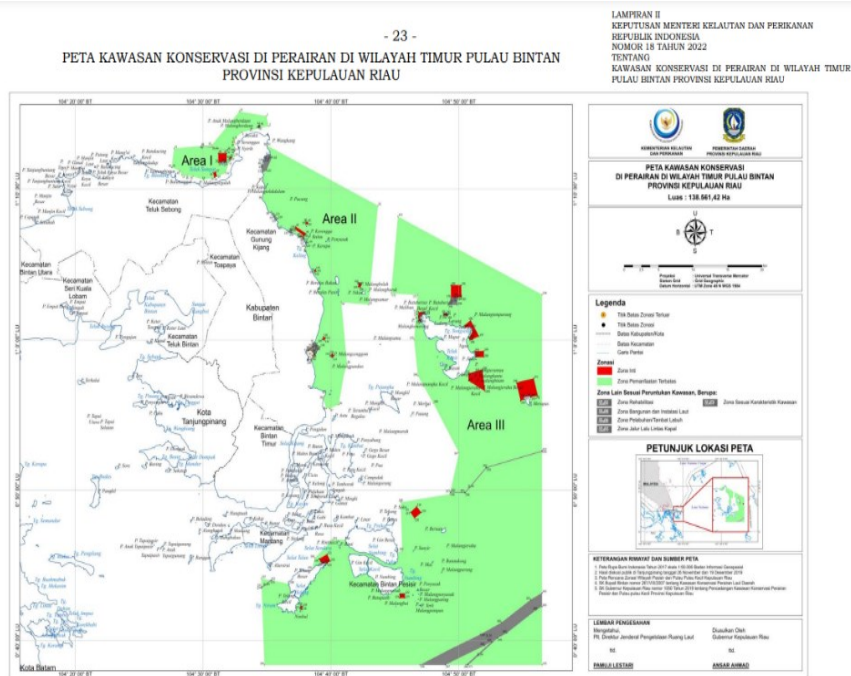
As a PnP example, in Indonesia, the Blue Halo S initiative integrates two elements of marine management that are often seen as conflicting with each other: ecosystem protection and economic production. This initiative promotes sustainable financing for multiple marine conservation and sustainable ocean economy development, where these two approaches close the ecological and economic loop between ocean production and protection. When the marine ecosystems (blue) are protected and well managed, the environmental benefits (halo) will impact local communities, for example, through livelihood and food security. The economic benefits of sustainable marine resources development are reinvested in environmental protection.

The Blue Halo S was launched in November 2022 in Bali, Indonesia, during Ocean20 (a side event of G20 High Level Conference). This initiative will be piloted in the Fisheries Management Area (FMA) 572 (West of Sumatera, Indian Ocean), covering 6 provinces, including the Aceh, North Sumatera, West Sumatera, Bengkulu, Lampung, and Banten. The program is envisioned as a scalable blueprint for national-scale implementation of blended financing strategies that advance marine and coastal ecosystem conservation, and sustainable development to achieve climate adaptation and mitigation outcomes.

Thus, ICM can be operationalized through the protection-production approach to achieve sustainable coastal development and management. The PnP approach would also ensure that there is funding available for protection activities within the management plan to ensure not only ecological but also financial sustainability.

## 4 Protection: Establishment of The East Pulau Bintan Marine Protection Area (MPA)

While the Blue Halo S Initiative is in the design and development phase, smaller PnP pilots are being trialled all over the country, including in the Kepulauan Riau Province. In this province, the protection component consists of the East Pulau Bintan Marine Protection Area (Bintan MPA here after), Kepulauan Riau Province. (Ministerial Decree No. 18/2022) The MPA establishment was initiated by Konservasi Indonesia in collaboration with Yayasan Ekologi Kepulauan Riau (YEKR) and strongly supported by the Ministry of Marine Affairs and Fisheries (MMAF).



**Fig. 1.** The map of East Bintan Island attached in the Ministerial Decree.

The Bintan MPA, which is under the category of Marine Tourism Park (TWP) has a total area of 138,561.42 hectares, consisting of three parcels; parcel-I of 4,553.54 hectares, parcel II of 23,293.48 hectares, and parcel III of 110,714.40 hectares (Figure 1). It has 2,101.87 ha of no-take zone, 110,423.45 ha of traditional fishing zone, and 7,815.69 ha of other utilized zone. The MPA zones were scientifically determined based on bio-ecological and socioeconomic surveys. Stakeholder consultations were conducted after the surveys to gain aspirations, desires, and objectives of all stakeholders, especially local communities, on the zonation. As a result, the MPA size and zones were a product of scientific and social processes that could bolster effective MPA implementation in the future.

Bintan Island’s proximity to Singapore has become a tourist hotspot with many resorts. However, without biodiversity conservation, the main tourist attraction would eventually erode away. The MPA would support the conservation of coral reefs and seagrass ecosystems of varying conditions. The bio-ecological survey indicated that the percentage of hard coral cover varies from poor to very good conditions with the average of 35.30% of coral cover (moderate category). The coral reef fish survey showed that 55% of species surveyed were carnivorous fish, 31% herbivorous fish and 14% coralivorous fish, which could indicate high

functional diversity within the ecosystem There are 7 species of seagrass found in 3 sites in the core zones, namely *Enhalus acoroides*, *Thalassia hemprichii*, *Cymodocea serrulata*, *Cymodocea rotundata*, *Thalassodendron ciliatum*, *Syringodium isoetifolium* and *Halodule uninervis*. Sea horses were also found at 2 sites within the core (no-take) zones.

As a part of the MPA establishment process, the Provincial government of Kepulauan Riau established the MPA management unit (Satuan Unit Organisasi Pengelola – SUOP) (Governor Decree No. 710 Tahun 2022 under Marine and Fisheries services). Among the responsibilities of SUOP are to develop and monitor the target improvement in the MPA area on the biophysical characteristics of the ecosystem (i.e., coral reef, seagrass, and mangrove), assessing fish stocks, socio-economic assessments of the community in the core zone of surrounding the MPA.

The East Pulau Bintan MPA aims to successfully preserve the integrity of the marine ecology, promote sustainable use of marine resources, uphold local traditions in resource management, and improve local community well-being. By 2027, the East Bintan MPA is expected to be effectively managed and will have accumulated enough monitoring data to demonstrate a reduction in illegal activities within the MPA boundaries; an increase in the abundance and diversity of species of fish and other marine fauna within MPA boundaries; increased fish catch for local fishers from MPA ‘spillover’ and new income streams for local community members related to the MPA.

## **5 Production: Sustainable Marine Tourism as Production**

Sustainable use of ocean resources for economic growth, and improved incomes and livelihoods need to be addressed while protecting the areas for conservation. Various economic potential can be identified as potential production in developing livelihoods for communities surrounding the area. In November 2022, a social economic survey was conducted at 11 villages to explore the potential sustainable marine tourism that exist in areas surrounding the MPA. The focus of the survey was potential economic development in fisheries, aquaculture and marine tourism. The results of potential marine tourism developments in the MPA area consist of hotels and resorts, water sports and tourist attractions (Table 1). To provide the most impacts and benefits for the communities and ecosystem in the MPA area, there is still a need to identify and design appropriate and sustainable intervention activities.

Community livelihoods must improve through the establishment of community-based enterprises in fisheries and tourism businesses. Transforming the Management Body from a government agency to a Regional Public Service Agency (BLUD) is one approach to attract funding from both government and non-government sources, including benefits from sustainable marine tourism. In addition, enabling the management body to coordinate the development and implementation of integrated programs in support of PnP across various agencies and sectors would be important. Maintaining the delicate balance in implementing protection and production programs is critical to ensure sustainable and long-term ecological and socio-economic benefits in the area.

**Table 1.** Potential sustainable marine tourism in East Pulau Bintan MPA.

No	Name of tourism	Type of tourism services	Village	Marine tourism package
1	Madu Tiga Beach & Resort	Hotel/Resort	Desa Malang Rapat	Water Sport and Tourism attraction
2	Nikoi Private Island	Resort	Kel. Kawal, Pulau Nikoi	Water Sport, Diving & Snorkeling
3	Binta Spa Villa	Hotel/Resort	Desa Teluk Bakau	Water Sport & Snorkeling
4	The Residence	Hotel/Resort	Desa Gunung Kijang	Water Sport & Snorkeling
5	Rumah Bintan	Boat rent and Water Sport equipment	Kel. Kawal	Water Sport, Tour Mangrove, Snorkeling and Diving
6	Trikora Beach Resort	Hotel/Resort	Desa Teluk Bakau	Water Sport, Snorkeling and Diving
7	Bintan Agro Beach & Resort	Hotel/Resort	Desa Teluk Bakau	Water Sport, Snorkeling and Tour Mangrove
8	Kelong Diver	Kelong* tourism	Desa Teluk Bakau	Water Sport, Snorkeling and Diving
9	Bintan Dive	Kelong tourism	Desa Teluk Bakau	Water Sport, Snorkeling and Diving
10	Pondok Nelayan Bintan	Kelong tourism	Desa Teluk Bakau	Water Sport and Snorkeling
11	Kelong Heri	Kelong tourism	Desa Teluk Bakau	Water Sport and Snorkeling
12	Marjoly Beach Resort	Hotel/Resort	Kel. Kawal	Water Sport
13	One of A Kind Resort	Hotel/Resort	Desa Teluk Bakau	Water Sport and Snorkeling

\* Kelong is a traditional floating fishing platform. However, a lot of kelong is now used as a tourist attraction or even as a floating homestay.

Source: Survey result on socio economic condition in Taman Wisata Perairan timur of Pulau Bintan Kepulauan Riau province, 2022.

## 6 Conclusions

The establishment and operation of the East Pulau Bintan MPA provides initial lessons on the application of the protection and production approach and ICM in support of Indonesia's marine conservation goals. MPAs is one of the protection approaches that are considered as most practical and cost-effective in ocean conservation and one of the primary tools for mitigating threats to and preserving marine biodiversity. If well designed and managed, MPAs can significantly contribute to protection and restoration of (blue) carbon rich ecosystems and enhance socio-ecological resilience. Protection of the area and its biological resources is the first step to maintaining fish stocks in the region and keeping the region and its biological resources conserved. However, the effectiveness of the MPA needs to be continuously monitored and evaluated.

The potential utilization and management of the East Pulau Bintan MPA as a sustainable tourism (economic production) area can have a positive impact on the surrounding environment. The establishment of the East Pulau Bintan MPA was designed to balance both

marine protection and production outcomes. This MPA could serve as one pathway to operationalize the ICM in Indonesia. The designation of the East Pulau Bintan MPA was conducted through several stages and phases to optimize ecological, sociological and economical outcomes. Surveys on the socio-economic and ecological conditions of the area, as well as policy-making processes from the provincial to the national government levels, have taken place to enable the application of protection principles in the utilization and other aspects of conservation. Without sustainability principles in management, the efforts to keep the values of life and the area sustainable will not be maximized.

Despite the need for a deeper study with more parameters, the designation of the East Pulau Bintan MPA and the initial process undertaken to assess the potential development of sustainable -tourism in the area can serve as a lesson learned for developing and implementing the protection-production approach and operationalizing ICM in the area. Further work is needed to develop a mechanism that will ensure coordination and balance between protection and production initiatives in the area, moving forward. In addition, additional research is needed to understand different production pathways in addition to sustainable tourism can be viable in different areas depending on the environmental and socio-economic context.

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