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Manta Ray Tourism

Maulita Sari Hani

Abstract

Manta rays are flagship species for marine conservation because of a number of threats including anthropogenic, overfishing, plastics (microplastics), over tourism, commercial trade (gills for medicine), and chaotic shipping lines where they often injured or killed. Because of these reasons, manta ray face risk of extinction and listed on the Red List of IUCN. A number of studies present the value of this fish estimated millions of dollars per year from tourism which show much greater valuable alive than dead. Responsible manta ray tourism encourages stakeholders to protect the species by generating incentives from tourism while develop conservations initiatives to protect the species. Desk study on current literatures were reviewed to identify the role of stakeholders in supporting the sustainable management of manta ray tourism. This chapter explored the operations of manta ray tourism in Indonesia as the study areas. In summary, to reach the positive contributions from manta ray tourism, there is an important role of co-management between stakeholders to ensure the sustainable operations and conservation of the ecology, economy, and socio-culture.

Keywords: wildlife tourism, ecotourism, tourism experience, community-based, marine protected areas, elasmobranch, conservation, sustainable tourism

1. Introduction

In the past decade, researchers have conducted studies on the increasing numbers of tourists who are observing marine wild animals, including manta ray tourism around the world [1–6]. It is still debatable how wildlife tourism possible bring positive contributions while other type of tourism rae still struggling to achieve its sustianbility. This chapter will explore the current opartions of manta rays toruism in Indonesia and identify the possible benefits form this type of tourism while also reviewed other benefits from different areas worldwide.

2. Manta rays

Deakos [7] described manta rays as belong to the taxonomic family *Mobulidae* which consists of 2 genera, *Mobula* (9 species) and *Manta* (2 species). A recent study by using molecular biology (DNA) combined the genera *Mobula* and *Manta* as one genus (*Mobula*) and confirmed the presence of two manta ray species, *Mobula alfredi* and *Mobula birostris* (**Figure 1**). The genus *Mobula* is characterized by the presence of one lobe on each side of the head, wing-like pectoral fins, terminal mouth and a stingless tail [8–11]. Unique characteristics possessed by manta rays are two head lobes (horns) and a frontal lobe for filtering plankton. **Figure 1**

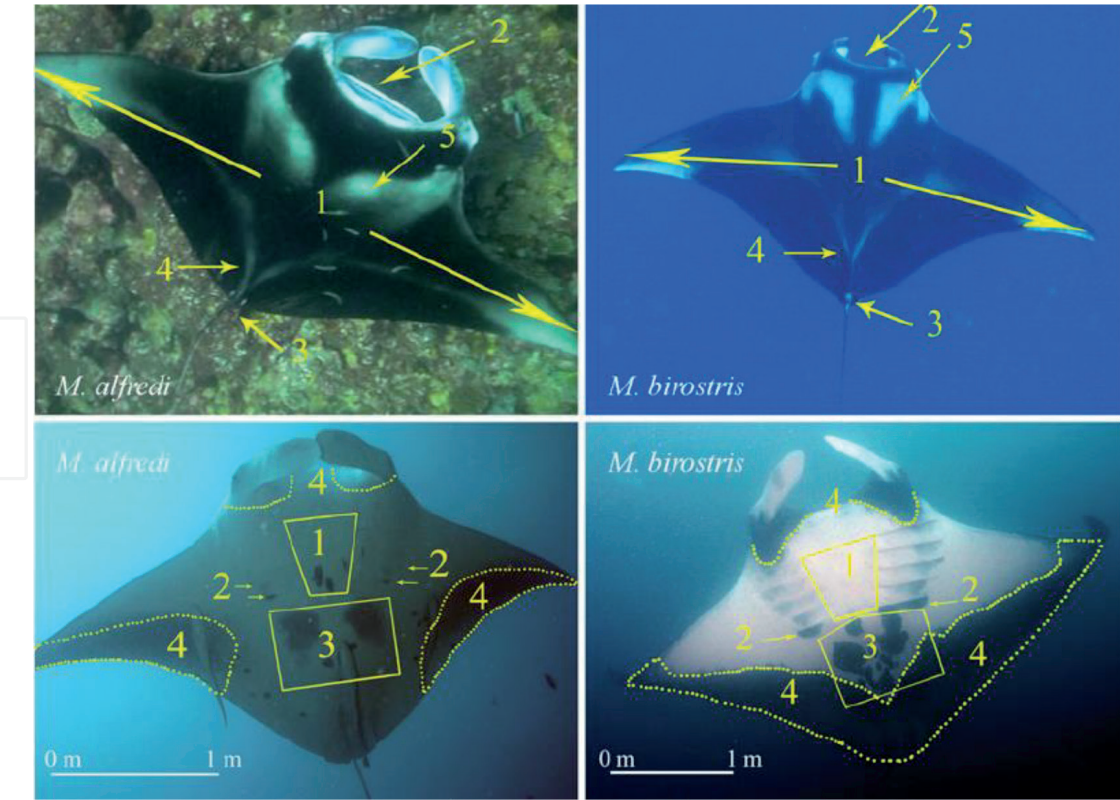


Figure 1.
Mobula alfredi and *Mobula birostris* (photo by Csilla Ari/University of South Florida).

shows the marks on the upper shoulders which form a pattern loosely resembling the letter “T” (*M. birostris*) or “Y” (*M. alfredi*) and serve as a marker for distinguishing the species. Furthermore, each individual manta ray has unique color variations, spotted patterns on the lower shoulders which can serve as fingerprints.

Among the largest fish species in the world, manta rays are gentle giants and are widely perceived as a charismatic species representing the ecological and social/cultural values of marine biodiversity. Manta rays are large planktivorous elasmobranchs generally found in tropical, subtropical, and temperate waters (Figure 2). Like other species in the mobulid family, manta rays are filter feeders [9]. Their frontal lobes help direct water to their mouths and over their highly sought-after gill rakers, where a great variety of planktonic organisms are filtered, including copepods, mysid shrimps, and arrow worms [12]. According [9, 13], they live for about 50–100 years and reach sexual maturity at an age of 10–25 years. Figure 1 shows *Mobula alfredi*, which grows up to an average wingspan of 3 m to 4.5 m with a weight of around 1.4 tonnes [7]. *Mobula birostris* is larger with a wingspan of up to 7 m and weight of up to 2 tonnes [10, 14].

Much like many other elasmobranchs, manta ray populations are comparatively small because manta rays are slow to mature, slow to grow and reach maturity, and give birth to a small number of offspring with long gestation times, not to mention their large size [8, 15]. These characteristics make manta rays intrinsically vulnerable to overexploitation, as the recovery of depleted populations will be slow at best [8]. In 2014, the Indonesian Ministry of Marine Affairs and Fisheries (MMAF) declared Indonesia as the world’s largest sanctuary for manta rays. MMAF prioritizes manta rays in Indonesian fisheries management under MMAF Ministerial Regulation No.4 of 2014 as a fully protected species based on Constitutional Act No.5, 1990. CITES has also listed manta rays in Appendix II meaning they are not necessarily imminently threatened with extinction, but trade in these species is controlled to avoid utilization incompatible with their survival. Furthermore, the



Figure 2.
Manta rays in Kofiau - Raja Ampat (photo by Patrick kun photography).

Convention on Migratory Species (CMS) listed manta rays in Appendices I and II while the International Union for the Conservation of Nature (IUCN) lists manta rays as 'Vulnerable' in the IUCN Red List [16].

3. Manta ray tourism

Charismatic species of marine wildlife become a driver for economic growth through marine wildlife tourism [17, 18]. Visitors want to experience seeing these animals first hand. Because of this reason, conserving marine species has benefits not just from non-consumptive uses, but also from the value of the ecosystem services provided by the species. According to [19]. Marine wildlife tourism is "any tourist activity with the primary purpose of watching, studying or enjoying marine wildlife". [20] gives a wider definition of marine wildlife tourism as activities that offer the acknowledgment of marine natural assets where the activities include fauna and flora whether marine or not. [21] describes marine wildlife tourism as offering different encounters between visitors and endangered species with a particular code of conduct where they are being cared for tourists' experiences. This statement is supported by [22] who emphasizes that the experience of wildlife tourism includes observation of the target animals in the wild, semi-captive, or captive environment. Marine wildlife tourism often provides encounter activities involving visitors which may be associated with limited seasons such as annual migration seasons and breeding times. Furthermore, [23] argues that, with some safeguards to protect the marine environment by limiting physical construction, this type of tourism can be sustainable. The role of government plays a significant role in providing guidelines and regulations requiring private operators to implement codes of practice for wildlife watching [20, 24]. In addition, marine wildlife tourism offers opportunities for education by encouraging awareness, knowledge, and attitudes about marine species and their environment as well creating an incentive for conservation to minimize human impacts [19, 20, 22, 24].

In the past decade, researchers have conducted studies on marine wildlife tourism, including manta ray tours, that showed a dramatic increase of global tourist numbers

[1, 2, 4, 19, 20, 22, 24, 25]. According to [4], manta ray tourism is a recreational activity to observe manta rays in the wild by diving, snorkeling, and observing from a boat (**Figure 3**).

Manta ray tourism has become popular with tourists because of the unique morphological characteristics and the behavior of these animals that are calm and friendly to humans. Manta ray encounters add an extra dimension to the visitor experience, in addition to their appreciation of conservation areas and related species. **Table 1** show global tourism hot spots for manta ray sightings.



Figure 3.
A tourist swimming with a manta ray in Kofiau - Raja Ampat (photo by Abdy Hasan/Conservation International Indonesia).

Australia	Great Barrier Reef Coral Bay
Ecuador	Isla de la Plata
Fiji	Kadavu Island
Hawaii	Kona & the Big Islands
Indonesia	Nusa Penida Island Komodo national Park Raja Ampat
Maldives	Throughout the Archipelago
Mexico	The Revillagigedo Islands Isla Mujeres & Isla Holbox Yucatan
Micronesia	Yap, Palau, Kiribati & Guam
Mozambique	Tofo Beach
Philippines	Manta Bowl, Donsol
Thailand	Koh Bon, Similan Islands
USA	Florida (Flower Garden Banks National Marine Sanctuary)

Table 1.
Manta ray tourism worldwide (adopted from [13]).

4. Manta ray tourism in Indonesia

Manta rays are found in the waters of Indonesia throughout the year but easily found at certain periods when 90% of tourists have the opportunity to see this fish. This condition makes the waters very unique and interesting to visit. These locations have also become the hotspots for manta ray tourism in Indonesia and combined make the second-largest manta ray watching industry in the world [4].

In 2010, Indonesia adopted the National Plan of Action for Conservation and Management of Sharks and Rays 2010—2014 as guidance and a documented commitment to implement sustainable management of sharks and rays in Indonesia. In alignment with policy at the national level, initiatives to protect the species at the regency level are also on the rise. Shark and ray protection and sustainable management policies are being formulated and implemented in several regions in Indonesia, mainly in areas where marine tourism is flourishing as a top tourist attraction and plays an important role in maintaining a healthy ecosystem. Pioneered in 2010, the Raja Ampat Regent enacted a decree to establish Raja Ampat waters as a shark and ray sanctuary, the first of its kind in the Coral Triangle. In 2012, the decree was then upgraded to Raja Ampat Regency Regulation Number 9 of 2012, leaving no loopholes in the law. Following this, in 2013 the Regent of Manggarai Barat formulated a similar decree addressing the protection of whale sharks and manta rays in Manggarai Barat Regency. Furthermore, in 2014 the Indonesian government declared full protection for both manta ray species and declared the entire Archipelago as a Manta Ray Sanctuary to support conservation and development of sustainable manta ray tourism.

There are a number of widely known manta ray sub-populations including in Raja Ampat, Komodo, and Nusa Penida based on studies conducted by Germanov and Marshall [26], Beale [27], and showed on **Figure 4**.

4.1 Nusa Penida

Nusa Penida is a sub district of Klungkung, Bali. Famous for its iconic landmarks, sandy beaches, and exceptionally high levels of marine biodiversity.

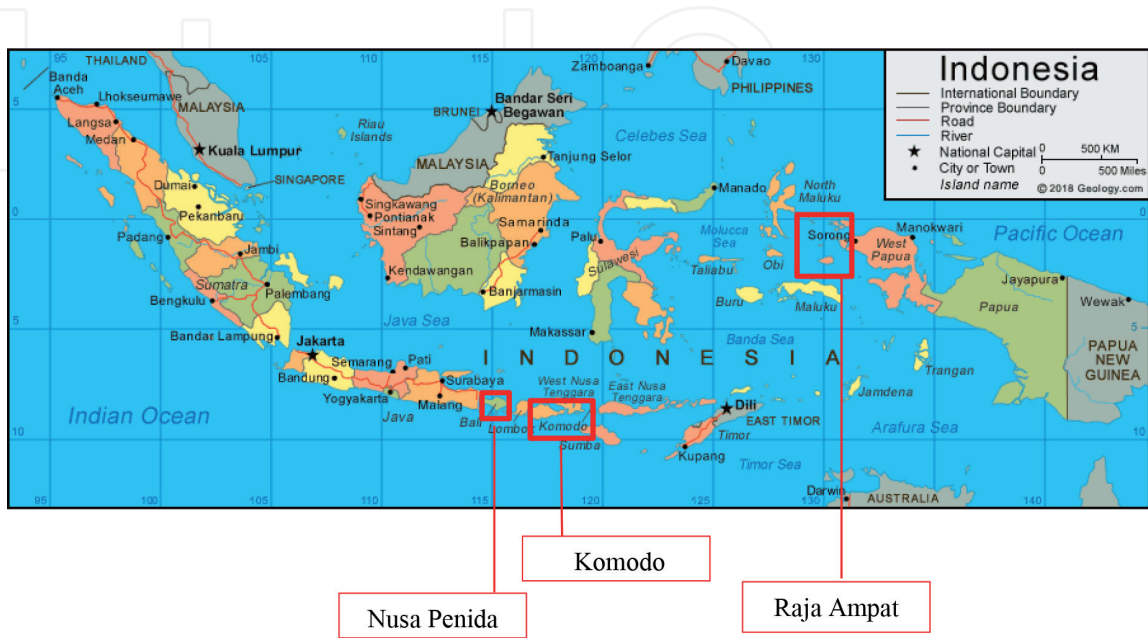


Figure 4.
Popular manta ray tourism in Indonesia (<https://geology.com/world/indonesia-satellite-image.shtml>).

Nusa Penida's underwater seascape invites thousands of tourists each year, especially since its designation as a priority site for tourist development. In recognizing Nusa Penida's potential for ecotourism as well as encouraging a blue economic growth, a part of it was established as a marine protected area. The Nusa Penida MPA is divided into different zones, with one particular zone allocated for marine tourism [28]. This led to a paradigm shift of socio-economic proportions for the people of Nusa Penida. Prior to its recognition, the people of Nusa Penida used to be farmers, fishermen, and craftsman. However, as the influx of tourists continues to increase, the demand for accommodation and amenities rises along with it. Rather than abandoning their previous occupations, the people of Nusa Penida instead integrate the new into the old. By mornings and nights, they tend to their farms and by day they tend to their jobs in the tourism industry. The community's shift to more tourism jobs is also, in part, fuelled by the local government's strict policy of mandating tourist operators and businesses to hire 50% of their work force from the local communities [29]. Nusa Penida is within the world's coral triangle and has high marine biodiversity. According to TNC, within the sub-districts of Nusa Penida, Nusa Lembongan, and Nusa Ceningan there are 1419 hectares of coral reefs, 230 hectares of mangrove forests, and 108 hectares of seagrass beds. Nusa Penida is famous for manta rays (**Figure 5**) and mola-mola.

4.2 Komodo National Park

Komodo National Park, established in 1980, is located between the islands of Sumbawa and Flores. This park's main purpose is to conserve the Komodo dragon (*Varanus komodoensis*) and its habitat, together with the entire biodiversity of the area. In 1986, UNESCO declared Komodo a World Heritage Site and a Man and Biosphere Reserve due to the Park's biological importance [30]. Komodo National Park has a total (land and water) area of 1817 km, with rich marine environments including coral reefs, mangroves, seagrass beds, seamounts, and semi-enclosed bays. More than 1000 species of fish, some 260 species of reef-building coral, and 70 species of sponges are found there, along with dugongs, sharks, manta rays, at least 14 species of whales and dolphins, and sea turtles. Manta rays in Komodo National park are a popular tourism attraction. In 2014, the Bupati of Manggarai Barat formulated a decree to address the protection of manta rays in Manggarai Barat Regency (**Figure 6**).



Figure 5.
A tourist swimming with manta rays in manta point - Nusa Penida <https://www.viator.com/en-ZA/tours/Kuta/Nusa-Penida-Snorkeling-Day-Trip-Discover-Manta-Ray/d22290-135130P26>.



Figure 6.
A tourist diving with manta rays in Karang Makassar - Komodo <https://amazingkomodo.com/store/product/diving-komodo-4-days.html>.

4.3 Raja Ampat

According to [31] Raja Ampat encompasses more than 4 million ha of land and sea and is home to more than 1400 species of fish and 537 coral species (75% of all known coral species). Raja Ampat is located in the north-western tip of Indonesia's West Papua Province, and includes the four large islands of Waigeo, Batanta, Salawati, and Misool, with hundreds of smaller islands [31, 32]. This MPA is a globally significant biodiversity hotspot because it provides a vital source of nutrition and a basis for local livelihoods. Manta rays serve as a conservation icon for Raja Ampat regency [3]. Although manta ray populations have been severely depleted elsewhere in the region, they are still abundant in the waters of Raja Ampat and have become a wildlife viewing tourism attraction (**Figure 7**). In 2012, the Raja Ampat Regency established a decree (No.9/2012) for the protection of manta rays.

Tourist volumes in these three locations has increased gradually. According to [5], approximately 70% of all tourists visiting Komodo view manta rays. This number was confirmed by the dive operators in Labuan Bajo, who stated that their trip packages included manta ray tourism, komodo viewing, and trekking. The annual report confirmed there were more than 50% of the annual tourists who joined manta ray tours. Previous studies from Hani et al. [33, 34] also confirmed the number of manta ray tourists in Raja Ampat and Nusa Penida show more than 50%.

Theses tourists visited the areas during the best seasons to dive or snorkel with manta rays which varied between research locations but manta rays can be found year-round. The estimated average sightings of 1–10 rays applied for diving and snorkeling, viewing from a speed boat, fisherman's boat, or a live-aboard. The involvement of local community members ranged from boat rental, equipment rental, making or selling manta ray souvenirs, providing accommodation, working as employees in tourism, and rangers. Below table describes existing manta ray tourism operations (**Table 2**).

Based on above table, a number of user fee system and control are varied. In Raja Ampat under the government management agency (UPTD) the user fee system are allocated into UPTD (84%) and local government (16%). These income distribute for conservation activities including patrol, marine resources monitoring (including manta rays), community education and outreach, conservation and tourism information centre. **Figure 8** described the its flow of transparency. In Komodo



Figure 7.
A tourist diving with manta rays in blue magic - Raja Ampat <https://blog.nationalgeographic.org/2014/09/17/transforming-indonesias-manta-fisheries/>.

	Nusa Penida	Komodo	Raja Ampat
Species	<i>M.alfredi</i>	<i>M.alfredi</i> , <i>M.birostris</i>	<i>M.alfredi</i> , <i>M.birostris</i>
Manta ray season	August to October	March to December	October to May
Tourist activity	Diving, snorkeling	Diving, snorkeling, viewing from boat	Diving, snorkeling
Average number of manta sightings	1–10 individual	1–5 individual	1–10 individual
Entrance fee (Foreigner)	USD 5	USD 17	USD 68
Community engagement	Tourism services (owners & workers), park officer	Tourism services (owners & workers), park officer	Tourism services (owners & workers), park officer

Table 2.
Manta ray tourism in Indonesia (adopted from [33]).

and Nusa Penida, the user fee based on the quantity of tourists activities (snorkeling, diving, trekking, etc). There is a different amount of user fee between local (domestic) tourist and international tourist.

In order to ensure the responsible behavior of manta ray tourist, there are some instructions, designed as a guide for tourists activities while interacting with manta rays. The local patrol ensure the implementation of code of conduct by monitoring the tourist activities to limit any negative impacts. **Figure 9** shows a number of interpretation materials provided for the tourists in Raja Ampat. Rules applied in Manta Sandy site include information on restricted zones, entry and exit points for speed boats and tourists, standard operating procedures, code of conduct for tourist interaction with manta rays, and manta ray education. The officers intensively socialize the rules and monitor visitor activities including the tourists and the operators.

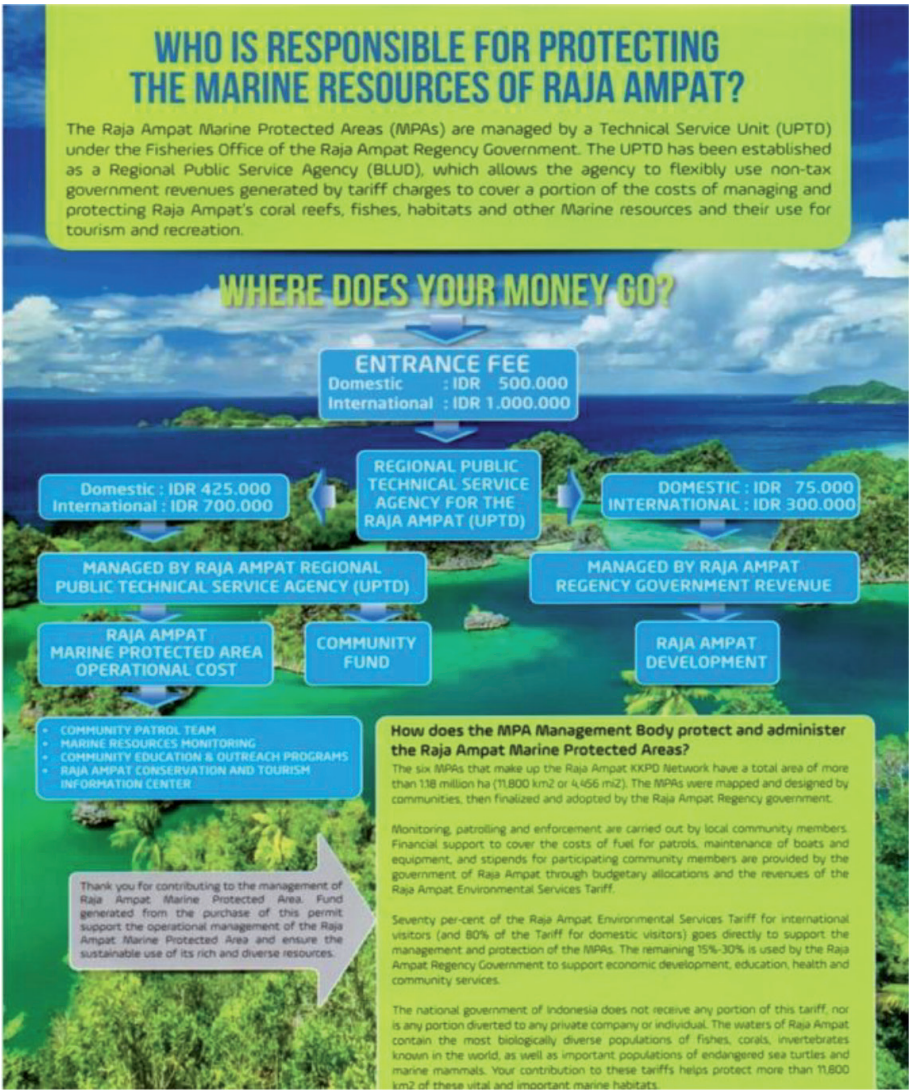


Figure 8.
Distribution of entrance fee in Raja Ampat.

In Raja Ampat, There is a facility named Manta Sandy Post (**Figure 10**) that was built in 2016 under an agreement between the stakeholders belonging to the Manta Rays Working Group (MRWG). The MRWG members comprise community leaders, tourism businesses, government agencies, professional associations, educational institutions, and non-governmental organizations (NGOs). Manta Sandy Post is run as a community-based management initiative where the stakeholders are engaged in supporting the funding and facilitate the physical operations. The officers are local people working under the BLUD, which manages the small MPAs scattered across the District. The BLUD officers are responsible for supervising the operation of sustainable manta ray tourism (tourists and operators) and tourist satisfaction, as well as monitoring violations and payment of fees for environmental services paid by tourists. Each tour operator is required to make a reservation at least one day in advance by phone or short message to the officer and to book for schedule availability. Based on the carrying capacity study conducted by [3], the limit for visitors allowed to be in Manta Sandy has been set at 20 divers and or snorkelers per hour. Meanwhile in Nusa Penida, a study of carrying capacity on manta ray sites has not been conducted so there is no limits on manta rays tourist numbers yet. In addition, The Komodo National Park has conducted related studies in 2017 and starting to implement a quota number on manta rays tourists on each site by working with the dive operators (**Figure 11**).



Figure 9. Interpretation materials for manta ray tourists.

Code of conduct and carrying capacity are not the only tools to sustain the manta ray tourism. A number of other initiatives are also essentials by utilizing the engagement of all stakeholders. Conservation initiatives at the three research locations have shown genuine contribution both from public and private sectors. The local operators and tourists participate in collecting plastics while diving and snorkeling, the operators also initiating regular beach clean-up activities, waste management, recycling, monitoring and patrol, species monitoring and photo ID. Different initiatives implemented in different locations where in Nusa Penida focusing on education and plastic collection while in Komodo and Raja Ampat there were more varied activities including citizen scientist (CS) to monitor the sightings of manta rays. Monitoring plays an important role to ensure the continued existence of manta rays and thus the continuity of tourism. **Figure 12** shows the conservation efforts by Conservation International Indonesia in deploying satellite tagging to tract manta rays in Raja Ampat. The same method has also conducted in Komodo and Nusa Penida by Marine Megafauna Foundation. In addition, photo ID of manta



Figure 10.
Manta Sandy post.



Figure 11.
Deployment of acoustic receiver and tagging (photo Conservation International Indonesia, 2020).

ray also collected from tour operators, community groups, and visitor were encouraged to participate in manta ray conservation management.

5. Discussions

Manta ray tourism operations in Indonesia show a number of engagement from stakeholders including public, tourists, tourism industry, government, park management, NGOs, community groups, schools, which enable them to establishment co-management of manta ray tourism. Co-management determines a joint effort from all related stakeholders to condense all aspects of the sustainability of tourism in one conservation initiative specially to catalyze sustainability within the tourism sector. Without sustainability, there cannot be tourism development that generates benefits for better livelihoods and preserves the species in question [35–38]. The concept of biodiversity is relevant when sustainable tourism affects the landscape, ecosystem, social and/or cultural processes where in this study manta ray as the charismatic species is the main tourism object. Charismatic species of marine wildlife become a driver for economic growth through marine wildlife tourism [39, 40], Visitors want to experience seeing these animals. For this reason, conserving marine species provides benefits from non-consumptive uses, but also from the value of the ecosystem services provided by the species. Wildlife viewing has been considered as a



Figure 12.
Economic value of manta ray in Indonesia “dead vs alive” (Conservation International Indonesia).

form of tourism based on the principles of making an active contribution to the conservation of natural and cultural heritage [41], emphasizing local participation in its planning and operation, so that it contributes to their wellbeing and empowers them in interpreting natural and cultural heritage to visitors. Previous studies confirmed a potential of significant economic generation from wildlife viewing, especially for remote island communities, has also been highlighted [22].

Studied conducted by Conservation International Indonesia together with other stakeholder showed the value of a single manta ray can be \$1million while it is still alive, but it is only worth \$500 when it is dead (Figure 12). Current study conducted by al Hani [42] identified the development of manta ray tourism in study locations encourage local community to establish small-scale tourism business including manta ray snorkeling tours and dive operators, manta ray souvenirs shops, homestay, guide, and others. The local engagement in various business allow them to receive economic incentives as well as encourage their business in conserving manta rays

with a number of conservation initiatives that has been mention earlier. Salazar [43], confirmed the community involvement in this type of business support the sustainability of the tourism assets (which is manta rays) to ensure their income generations.

Furthermore, a recent study [4] calculated an industry value of US \$ 140 million per year worldwide. An economic valuation study at manta dive sites in the Maldives, estimated 143,000 dives and more than 14,000 snorkel trips each year during the period 2006–2008 [2], with an estimated economic value of around US \$ 8.1 million per year through direct income.

The economic value of manta rays in Inhambane Mozambique province was also high, generating \$ 10.9 million per year in direct income through diving activities with an estimated direct economic impact (expenditure during the tour) of US \$ 34.0 million every year [44]. With no manta ray tourism, it was estimated that a value of between \$ 16.1 million and \$ 25.7 million would be lost to the region each year if manta rays are not carried out with a sustainability strategy. The results of a survey of tourists and stakeholders emphasize the importance of increasing protection of manta rays and their habitat through effective conservation area management for tourism [44].

In a different study emphasizes the importance of the effective role of conservation areas was identified as having implications for the environmental health of ecosystems and the manta ray ecotourism industry. This researcher explained that the manta ray aggregation areas in Sudan are protected by zoning rules and utilized for ecotourism. The ecotourism development involved local communities through employment and capital investment for tourism industry facilities but lead to a dilution of traditional Sudanese culture. A study to analyze the ecological value generated from manta ray viewing by utilizing video recordings to record tourist-manta interactions was carried out six feeding aggregation sites, and six cleaning stations, in Baa Atoll, Maldives Republic. The behavior of tourists was limited to passive observation, intentional obstruction, diving below or near manta, and deliberating contact with manta. In Indonesia (Raja Ampat and Komodo) a number of interpretation materials used to educate tourists and public, monitoring and patrol activities are conducted regularly, as well as carrying capacity studies to limit the number of manta ray tourists and many conservation initiatives to protect the species and its habitat.

In Indonesia, people has local belief that manta rays bring luck on their waters, many indigenous in Papua (including Raja Ampat), keep their traditional values from generations to generations to protect the species besides it is a flagship species for conservation. Research on social and cultural aspects was conducted on the social value of manta ray tours in Hawaii [45]. In 2017, a study of diving and snorkeling of manta rays resulted in conflicts. The survey from 444 participants showed 79% of snorkeling groups experienced conflict with other snorkelers, and 53% of scuba divers reported conflict with other divers. The physical interactions between individuals interfered with the experience. The forms of behavior during conflicts included crashing into people (up to 92%), unconsciousness (up to 73%), and people dazzling others with underwater flashlights (up to 56%). The level of conflict between groups was found to be less between different activities (snorkelers and divers) with some minimal social conflict such as negative prejudice, and no physical interaction between individuals.

6. Summary

Manta ray tourism has many positive contribution on economy, environment, and socio-culture. The benefits are varied, start from financial contributions to

community and conservations (animal welfare), education, economic incentives from manta ray tourism business, and others. However, there is an essential factor that play an important role to make this happened, is the implementation of co-management between stakeholders to work together and play their own role in supporting the sustainable management of manta ray tourism.

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