Strategic approaches in manta ray tourism management

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Abstract. Manta ray tourism has both positive and negative impacts. Therefore, this type of tourism should be managed appropriately, especially in protected areas. There are a number of protected areas in Indonesia which have become popular as manta ray tourism destinations. These tourism destinations are visited by thousands of tourists every year. Excessive tourist numbers with uncontrolled behaviour can potentially impact the species. This study was conducted to examine effective management strategies to mitigate overtourism in manta ray tourism at three sites: Komodo, Nusa Penida, and Raja Ampat. The target respondents included 73 relevant stakeholders. This descriptive research conducted during 2017-2018 involved the collection of quantitative information and utilised questionnaires. The results identified seven existing approaches to effective management of manta ray tourism in order to mitigate overtourism in the study areas. Key recommendations to improve mitigation are highlighted.

1. Introduction
Manta rays are the largest fish in the family Mobulidae. Several studies have shown that there are two species of manta ray: Mobula alfredi (reef manta ray) and Mobula birostris (oceanic manta ray) [1–3]. The reef manta ray is one of the largest fish living in tropical and subtropical waters along Indo-Pacific coasts [4–7]. This fish is a migratory species that gathers in groups to feed and travel. Individuals can reach 3-5 m in width with a weight of up to 1.4 tonnes [4,5]. Both manta rays are highly intelligent fish; they have the largest brain to body ratio known for any fish, with high cognitive functions and a well-developed long-term memory. Special characteristic of manta rays include the triangular pectoral fins and diamond-shaped body with cephalic lobes (two horn-shaped protrusions at the front of their head) [2,3]. The normal colour pattern is black and white with patches. As filter feeders, these fish swim with their mouth open, creating a vortex effect to trap zooplankton and krill [8–10]. They visit cleaning stations where they get cleaned from parasites and dead skin by cleaner fish. In addition to anthropogenic pressures, manta rays are also under threat because of their slow rate of reproduction, overfishing, microplastics, and uncontrolled tourism [11–15]. Because of these threats, manta rays are listed as Vulnerable in the Red List of the International Union for Conservation of Nature and also listed in Appendix II of the Convention on International Trade in Endangered Species (CITES) [16]. As described by Hani et al. (2007), in Indonesia manta rays are fully protected since 2013 and this country has created the largest manta ray sanctuaries that are also utilized for tourism [17,18].

The development of tourism has shown an ongoing growth in the numbers of people travelling from all around the world, with rising demand for tourist travel worldwide. Tourism trends include the offer of affordable domestic and international accommodation and transportation, as the increase of disposable income, marketing, holiday seasons, and popular destinations enable people to increase their mobility. Moreover, the growth of the middle class and the millennial generation, along with the rapid
technology that supports travel connectivity making distant places more reachable, encourage people to explore the world. Phi (2019) and Milano et al. (2019) described how the growth of tourism can put pressures on a destination and/or an attraction, with the number of tourist arrivals bringing excessive visitor growth that leads to overtourism [19,20]. The World Tourism Organization (UNWTO) describes overtourism as a “situation in which the impact of tourism on a destination, or parts thereof, excessively influences the perceived quality of life of citizens and/or visitors in a negative way” [21]. Furthermore, Higgins-Desbiolles et al. (2019) and Peeters et al. (2018) defined overtourism as a situation where visitor numbers exceed the social and physical carrying capacity of a destination [21,22]. It is a phenomenon where a tourist destination is overrun by too many visitors and overload with infrastructure. This situation has emerged in all kind of destinations including city, parks, museums, beaches, and others. Factors contributing to overtourism include the growth in tourists that eventually affects the supply of services to tourists [23]. According to some research, overtourism is not only about the excessive numbers of tourists but also the behaviours that have negative impacts on destinations [19–22]. Many destinations have faced spatial conflicts due to the limited carrying capacity which have resulted in demonstrations by the local people. Protests by the host community have been reported from Barcelona, Valencia, Venice, Rome, and Dubrovnik [24–29]. They held “anti-tourism” demonstrations and complained because the number of tourists exceeded the local population. Problems which have occurred include pollution, the degradation or devastation of nature, overloaded infrastructure, distressed local populations, wildlife disturbance, limited public access for locals, and threats to local culture and heritage [21,22]. To handle this issue, many destinations have experimented with strategies to mitigate or cope with overtourism. An effective strategy is important to overcome the challenge of overtourism while taking a broader understanding of the whole tourism management plan.

Management of manta ray tourism, especially in Marine Protected Areas (MPAs) is generally based on spatial planning (zonation). Experiencing the encounter with manta rays in the wild by diving, snorkelling, or viewing from boat can be a spectacular moment for tourists and had become a popular attraction worldwide. Manta ray tourism has been growing for the past decade with an increasing number of hotspots worldwide along with the growth of visitor numbers [5,17,30]. Overtourism has potential impacts including perpetuating exploitative manta ray tourism by creating a demand for manta ray encounters which pose a threat to the already endangered species. Based on these background issues, this study analysed a number of key strategies that could be effective to mitigate overtourism in Eastern Indonesia.

2. Methodology

The three study areas were Komodo, Nusa Penida, and Raja Ampat, all of which are designated as MPAs and identified as manta ray tourism hotspots in Indonesia. There were 73 targeted respondents, all of whom were stakeholders involved in manta ray tourism from various institutions. They included park managers, and key informants from non-governmental organisations, community groups, and small-scale manta ray tourism businesses. The data were collected from 2017 to 2018 with the assistance of six local enumerators using semi-open questionnaires, and the interviews were recorded.

3. Results

3.1. Monitoring

Monitoring activities play an important role to ensure the continued presence of manta rays and thus the continuity of tourism. Monitoring of manta ray sightings in study areas collected photo ID records of manta rays (photos showing the spot patterns unique to each individual M. birostris or M. alfredi) and satellite tags. The monitoring documented detected manta rays with the location coordinates, time of day and date of each sighting.

The photo ID database developed in Raja Ampat uses simple reports from local conservation groups, manta ray operators and tourists, a form of citizen science (CS). Furthermore, a monitoring post developed by the Raja Ampat manta ray working group (Pokja Manta) serves as a check point for visitors
before they can proceed to encounter the rays, to ensure payment for the ecosystem services (Figure 1). Tourist visits are documented by the local rangers who work for the Conservation Area Public Services Agency (BLUD UPTD); this information is useful to understand visitation patterns as well as visitor profiles.

Figure 1. Manta Sandy Post in Raja Ampat (Source: Arnaud Brival).

3.2. Interpretation and education
The Pokja Manta has produced interpretation materials for manta ray tourists. The information is provided with interactive infographics. Interpretation by the rangers educates the manta ray tourists on important aspects of manta ray conservation in addition to the procedures and interaction guidelines designed to regulate their behaviour. The interpretation materials include codes of conduct for snorkelers and divers, entry-exit zones and zonation, and basic information on the species entitled manta 101 (Figure 2). To ensure the tourists contribute to the conservation of manta rays, both the visitors and the boats stay in specific areas to mitigate any disturbance to the species. These interpretation materials are displayed as an effort to control tourist behaviour by delivering education on the importance of conserving the species.

Figure 2. Interpretation materials in Manta Sandy - Raja Ampat for manta ray tourists.
3.3. Spatial configuration
The spatial management strategy approach should be optimised based on scientific studies for the provision of physical infrastructure in order to regulate the movement of tourists, including tourist transportation moorings such as speed boats and live-aboard boats. A spatial approach was identified in Raja Ampat. Examining the ranger post at Manta Sandy showed that the MPA regulates access by implementing zonation with specific areas for manta ray encounter activities (snorkelling and diving), boat parking, facilities, and restrictions on zones used by boats (Figure 3). The designated sites are also managed based on carrying capacity; a maximum of 20 people per hour can visit the site and reservations must be made a day in advance. Data from monitoring are a significant resource for park managers to design visitor management strategies to control the numbers and behaviour of manta ray tourists. The strategy plays an important role in distributing tourist volume while maintaining tourist satisfaction (based on their profiles) and protecting the important habitat of manta rays (cleaning stations and feeding areas) by implementing closures at particular seasons in specific zones. This approach encourages manta ray tourism hotspots to regulate access by implementing zonation.

![Figure 3. Encounter zone for divers in Manta Sandy – Raja Ampat.](image)

3.4. Entrance fee
The MPA entrance fees differ between the three locations. Entrance fees to Komodo and Nusa Penida are USD 6 per visitor while in Raja Ampat the fee is USD 30 for domestic and USD 60 for international tourists. The annual income of these MPAs during 2017-2018 shows that Raja Ampat received almost 5 times more (USD 1,266,236) than Nusa Penida (USD 281,386) and Komodo (USD 196,947). In Raja Ampat, more than 50% of the tourists took manta ray tours, indicating that manta rays are an important tourism asset. The tourist volume has been increasing every year, by an estimated 20 to 50% depending on the site. There was some leakage from entrance fees in all three research locations, but the leakages were found to be much higher in Komodo and Nusa Penida. Reasons tourists did not pay the entrance fee included a lack of control by the parks; also, tourists only received a ticket as payment receipt.

When visiting Raja Ampat, each tourist received a special card with an ID number, and there are several check points where the tourists are obliged to show their card (called Kartu Jasa Lingkungan, more often referred to as KJL) to the rangers when traveling within Raja Ampat (Figure 4). The imposition of a high entrance fee has filtered the type of tourists visiting the area which represent middle and upper classes in their country of origin, and the profiles show that most travellers had a highly responsible attitude. The income from tourist entrance fees is allocated to conservation activities in the MPAs, including manta ray and tourist monitoring which involve the local community. This is regulated by regional law under PERGUB Papua Barat No.4 of 2019. Moreover, the local community are financially supported to engage in conservation initiatives while preserving the traditional values, and some locals are hired as rangers.
3.5. Small-scale manta ray tourism businesses
Local community members were involved in or running small-scale manta ray tourism businesses in all three study areas, but such activities by locals were more prevalent in Raja Ampat compared to Nusa Penida and Komodo. The engagement of the local community in small-scale manta ray tourism businesses plays an important role in regulating the behaviour of manta ray tourists, include briefings and tourist volume. In Raja Ampat, the services provided are nature-based and make use of private assets that are generally environmentally friendly. Furthermore, the local community also engage in a number of conservation initiatives and engage the tourists to support conservation. Their services offer local values including tradition, culture, and nature that support conservation initiatives, community engagement, and result in the utilization of natural resources in eco-friendly ways that positively impact their economic welfare. In Nusa Penida and Komodo, the local businesses provide water-borne transportation for manta ray tourists with a number of different options, including local boats, speed boats, and live-aboards (Figure 5).

However, this study found a marginalization of local small-scale manta ray tourism businesses. This was clearly visible in Komodo and Nusa Penida where the dive shops are dominated by investors from outside the community (foreigners and Indonesians mostly from Jakarta). In Nusa Penida, only 1 local dive shop owner offered manta ray diving and 1 community working group (consisting of ten members) offered boat and gear rental for manta ray snorkelling trips. In Komodo, 11 locals were involved in small boat rental businesses (4 of them also being tour operators) and 6 people produced manta ray themed souvenirs (necklaces and other crafts). In Raja Ampat, there are hundreds of rooms, tour operators, and

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**Figure 4.** Kartu Jasa Lingkungan (KJL) issued as an ID card to each tourist visiting Raja Ampat.

**Figure 5.** Local boats used for manta ray tourism in Komodo (a) and Nusa Penida (b).
dive shops. In summary, their engagement in tourism has direct economic impact and encourages their initiatives in promoting manta ray conservation from their revenue.

3.6. Co-management and partnership
Working groups have been established in Komodo and Raja Ampat as a model of a collaborative management between government, tourism operators, NGO’s, universities, and community groups. The study found that the working group members cooperate and collaborate to initiate a number of conservation activities including patrols (report any infractions), socialisation, research and monitoring. They also work together to support logistics and public facilities. Regular meetings were conducted to evaluate current management.

3.7. Women’s engagement
A number of conservation initiatives in Komodo and Raja Ampat inspired the local community of Koperasi Serba Usaha (KSU) Komodo to provide support in many ways. This included a recycling program in Komodo by a women’s working group that promotes the conservation of manta rays by creating manta ray souvenirs from old calendar sheets (Figure 6b). In addition to manta rays, this group also produced souvenirs representing other endangered species including komodo dragons and sea turtles. The involvement of women in Raja Ampat was evident in the way they utilised the natural resources in their traditional weaving techniques. They produce manta ray souvenirs that added value to their weaving products, including woven manta ray hats, manta ray pendants from coconuts and shells, etc. (Figure 6a). These handicraft traditions have been passed down through generations in the surrounding islands. This study recorded around 50% direct participation by women in manta ray tourism, in addition to the indirect participation of women in supporting their husband or family business. The services they provided included work as chefs, room service staff, and serving as local guides. These women are agents for conservation who are able to send a message through the souvenirs they produce and influence the visitors to protect the species by being responsible tourists.

Figure 6. Local women’s working groups in Raja Ampat (a) and Komodo (b).

4. Discussion
Manta rays are sensitive to human behaviour; uncontrolled and inappropriate interactions may drive them away from their aggregation areas. Manta ray tourist behaviours examined potentially support manta ray conservation but can also disturb the animals in a situation of overtourism during encounter activities [18,31–33]. A study confirmed that interpersonal and social conflict can occur between divers and snorkelers during manta ray encounters [31]. Science-based guidelines and legislation have become essential tools to control the behaviour of manta ray tourists so that they can have the best possible
experience and to avoid possible conflicts [31,34]. Practical information based on scientific data to educate tourists for the quality, safety and sustainability of manta ray tourism is available in Codes of Conduct for swimming with manta rays, with practical guides on how snorkelers and divers can engage in responsible behaviour to ensure their safety and maximise their experience, while protecting the species from disturbance [31,32,34–36].

The protection of species serving as tourism attractions has become a growing concern, especially in protected areas. Many protected areas have struggled to overcome over-tourism and control tourist behaviour, especially with regards to wildlife, in part because of a lack of quantitative and qualitative knowledge of the wildlife and visitors [37]. Overtourism is related to temporal and spatial tourist trends. These concerns mean that it is important to identify a number of aspects. Most wildlife tourism destinations are seasonal, meaning there are particular busy periods that need to be identified. UNWTO reported that, while every destination is a site-specific case, the global annual visitor growth was approximately 7% in 2018 [38]. Forecasting short and long-term visitor numbers is essential to support visitor management, and requires data from regular monitoring of both the wildlife as the attractions and tourist patterns. Such information is essential to enable park managers to design visitor management strategies to mitigate and minimise negative impacts from over-tourism in order to support sustainable tourism and species protection. As highlighted by Albrect (2016), visitor management is a component of destination management which plays an important role by managing visitor movements and influencing their behaviour [39]. It is important to develop sustainable manta ray tourism because it makes the rays worth more alive than dead, bringing economic incentives and benefits to the local community [6,17,18,30,34,36,40].

5. Conclusion
Mitigating over-tourism is better than recovering from it. Ideal tourism management practices are designed based on scientific data to prevent future negative impacts and should be considered an essential part of tourism planning that contributes to sustainable tourism. Approaches such as spatial planning strategies, education/interpretation, user fee systems, stakeholder engagement in small scale businesses, co-management, and partnerships all play essential roles [40]. There are many options for managing the visitors; not all will be effective or appropriate because it is site specific. There are many other factors which also contribute to the successful mitigation of over-tourism including an effective monitoring system on tourist visits and manta ray detection. Such information can be collected by utilizing data from satellite tags, photo ID of manta rays, entrance tickets (e.g. the KJL), accommodation data, surveys, and observation. Such data are very useful as a basis to develop strategies and proposed actions to mitigate over-tourism and to ensure the protection of manta rays including the control of manta ray tourist numbers and behaviour. Comprehensive guidance and protocols are required as part of the management frameworks of each destination. Based on previous studies [35,41], an adaptive approach which promotes ethical and responsible travel with the three pillars of ecology, economy, and socio-cultural aspects should be implemented. This study identified Raja Ampat as the site with the most effective management strategy for manta ray tourism in Indonesia, with best practices to mitigate over-tourism. Recommendations from this study include further studies to identify impacts of tourists on manta rays, and continuous monitoring of manta ray and tourist numbers to ensure data as a basis for evaluation of the measures implemented. We also recommend online “manta ray tourism” booking systems and monitoring platforms, and a certification system for sustainable manta ray tourism operations.

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