

Impact of Coral Reef Damage Due to Tourism Activities in Karimunjawa National Park

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Abstract. Tourism in Karimunjawa National Park is one of Central Java Province's main tourist sectors. Every year tourists visiting the Karimunjawa Marine National Park always increase. The domestic and regional market has driven the development of the Karimunjawa Islands as a tourist destination. It is promoted as a spot for diving and snorkeling, with the community participating as a provider of tour operator services, tour guides, and accommodation. Tourist visits that increase yearly raise concerns about the sustainability of tourism activities for the ecological sustainability of coral reefs. This paper aims to determine damage to coral reefs in Karimunjawa National Park due to tourism activities.

1 Introduction

Tourism is a fast-growing industry in Indonesia. In addition to natural resources, Indonesia also has good tourism potential that can be developed from nature, history, and human resources. According to the Minister of Tourism, based on the version of The World Travel & Tourism Council (W.T.T.C.), Indonesia has the ninth (9) highest tourism growth globally. [11]. Tourism also includes the classic industry and souvenirs [19]. Most countries develop tourism activities [15] to; expand employment opportunities and business fields as well as state foreign exchange income, introduce national culture, maintain the personality of national culture and foster a sense of love for the homeland, encourage regional development while still paying attention to environmental sustainability.

According to Article 1 paragraph 4 of Law Number 10 of 2009 concerning Tourism, it is explained that tourism is all multidimensional and multidisciplinary activities related to tourism that arise as an expression of the needs of each person and country as well as interactions between tourists and local communities, communities, fellow tourists, the Government, Local Government, and entrepreneurs. This shows that tourism has a multidimensional and multidisciplinary nature. Tourism is an industry that includes various aspects ranging from transportation services, hotel accommodation, natural scenery including mountains and beaches, entertainment activities in various arts, and the latest culinary culture tourism developments. Tourism activities are required to meet the needs and

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harmony with interactions between the government, tourism industry entrepreneurs, employees, tourists, and those who do not know the importance of local communities that are not only oriented to the present but also future generations related to economic, social, environmental growth that is sustainable—always seen from the needs of tourists, the tourism industry and the local community [10].

Ecotourism, or ecotourism according to Pendet (2006), is a trip or visiting an area that is naturally relatively undisturbed, with a genuinely objective intention to see, study, and admire the face of natural beauty, plants, and fauna, including cultural aspects both in the past and present. That may exist in the area.

Some of the critical aspects of ecotourism are: the number of visitors is limited or regulated to suit environmental and socio-cultural capacities; environmentally friendly tourism (HCV) patterns; patterns of local customs that are culturally and tourist-friendly (value education and tourism); help direct the local community's economy (economic value); the initial capital required for infrastructure is not significant (community participation and economic value) [21].

The Karimunjawa Islands have tourism potential and are supported by a National Park, and the Karimunjawa Islands are pretty strategic. Some of the potentials in the Karimunjawa Marine National Park [1] are: high biodiversity, especially in coral reefs, mangroves, and seagrass beds. An area with natural beauty with pristine and beautiful forest conditions, white sand on its beaches with coral reefs surrounding each island, the existence of endemic Dewandaru trees, green turtles, and hawksbill turtles, hawksbill turtles, eagles, and red clams. High resource potential, marine tourism, and environmental tourism and recreation are aimed at a national and international scale.

The development of Karimunjawa National Park as a tourism destination has been encouraged by the domestic and regional markets and promoted as a destination for diving and snorkeling with community participation as a provider of tourism services, tour guides, and accommodation [4]. Tourist visits that increase yearly raise concerns about the sustainability of tourism activities for the ecological sustainability of coral reefs [2].

Coral reefs are tropical ecosystems that are found in Indonesian waters. Its existence has high productivity, economic, and ecological value to the environment and humans around the ecosystem [29]. Coral reefs in the Karimunjawa Islands are found in almost all island areas, with a live coral cover range of 7-69% [30]. The average live coral cover in the Karimunjawa Islands is 54.6%. The number of hard corals that make up the coral reef ecosystem is 69 hard corals (*Ordo Scleractinia*) and three non-*Scleractinia* orders. The high biodiversity of the Karimunjawa Archipelago and all coastal ecosystems and small islands has made this area designated as a protected area of the Karimunjawa National Park based on the Decree of the Minister of Forestry and Plantations No. 78/ Kpts-II/1999 covering an area of 111,625 hectares divided into waters of 110,117.3 hectares and 1,507.7 hectares and managed by a zoning system.

Tourism activities are carried out by utilizing coral reef areas; coral reefs will always experience pressure and are vulnerable to causing damage [22]. Degraded coral reefs are closely related to existing diversity. They can even change the dominant type of coral reef; for example, changes in dead coral reefs will be overgrown by algae, in addition to changes in the dominant type of degraded coral reefs also have an impact on factors related to physical attractiveness, reef fish, and ability to maintain their structure as a breakwater, social and economic impacts will also be reduced [7,8].

Karimunjawa National Park is productive water with hard coral cover; in addition to natural factors, coral reef cover is also influenced by high utilization rates [25].

Concerns that exceed the environment's carrying capacity will be increasingly vulnerable along with the development of tourism activities on small islands with limited natural

resources. Tourism operators always meet the needs of tourists in carrying out tourism activities [3, 28].

2 Method

The observation locations were carried out on 3 (three) islands representing the protection zone (marine), the utilization zone (maritime tourism), and the outer zone of the Karimunjawa National Park area. For completeness of data in order to represent sampling points on an island, secondary data was collected from existing research results. The Manta Tow method before setting the sampling point was also carried out to ensure the accuracy of the resulting data. The Manta Tow method is a coral reef observation technique using an observer behind a motorized boat using a rope as a link between the boat and the observer. With a fixed-speed boat passing over the coral reefs with a towing time of 2 minutes, observers will see several objects that pass and the value of live and dead coral cover. The observed data is recorded in the data table using category values or integer percentage values. For additional information on observing this, it can also be observed and recorded the percentage of sand cover and coral fractures as well as other objects (Kima, Diadema, and Acanthaster) that are seen in the observation, all depending on the purpose of the observations to be carried out [24].

3 Results and Discussion

Karimunjawa Island and Kemujan Island have natural resources and socio-cultural, economic, and institutional characteristics because they are coastal areas used for tourism activities. With the development of tourism in the region, several changes have occurred. Along with the increasing number of tourists who come to Karimunjawa yearly, it continues to impact society and the environment.

Snorkeling tourism activities cause damage to coral reefs. This is caused by the long reach of tourists' feet with the use of fins either accidentally or intentionally can touch the reefs, and the mixed sediments can cover and bury coral reefs [5] the stirred sediments can also interfere with the growth and reproduction of corals [17].



Fig. 1. Tourist activities stepping on coral reefs

In addition to fins, tourists can also potentially damage coral reefs through the equipment used, holding, sitting, standing, and stepping on corals [20, 23] these behaviors are usually carried out by novice tourists [5, 27]. Physical contact caused by tourists has different impacts on different coral organisms [13]. Coral polyps with massive lifeforms in receiving damage are cumulative. The percentage of damage depends on the amount of friction received. In contrast, coral polyps in branching lifeforms depend on the strength received immediately. If the whole colony is considered, damage to branching lifeforms can be catastrophic a cumulative number of broken branches [14].



Fig. 2. Tourist Activities Holding Coral Reefs

Damage to coral reefs in the three tourist spots was in the form of partial colony death, eroded coral colony surfaces, the damage occurred in massive, digitated, encrusting coral lifeforms, and broken coral branches.

Eroded surface coral colonies tend to cause pathogen invasion and increase mortality [9, 14], whereas the number of partial deaths of coral colonies on a reef can represent the condition of coral reef health to high stress, and can illustrate the process of changing dynamics in corals [6].

Indirectly, tourism operators also have the potential to damage coral reefs, such as mooring boats on massive reefs, because the number of boats operating simultaneously exceeds the capacity of the mooring buoy, selecting areas in tourist spots that can be reached by fins tourists and operators who are passive or do not reprimand against tourist behavior that has the potential to damage coral reefs, and even participate in stepping on corals when carrying out underwater photos and tourist supervision. Feeding fish by tourists facilitated by tourism operators can have positive or negative impacts, such as changes in the abundance, habits, and size of fish in certain species, attracting fish with great aggression, or helping small fish populations [16, 18, 31]. Fish behavior can also change in the face of the environment, which is a part of adaptation, or even changing the food chain, in carrying out tourism activities. Feeding fish can give a distinct impression to tourists, and for tour operators is also an effort to serve and attract tourists in the hope that visitors have the desire to return to visit tourist sites.

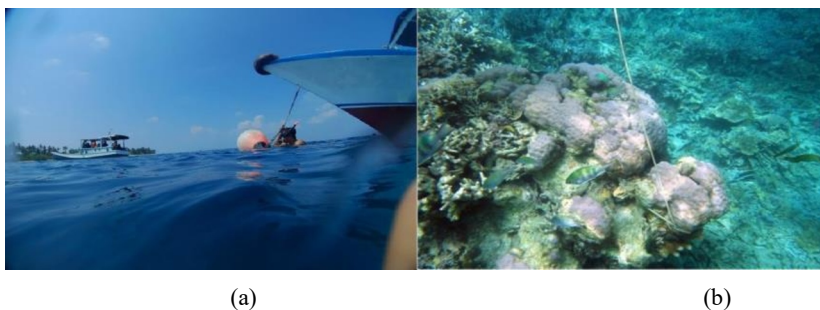


Fig. 3. (a) Physical contact of the tour operator in mooring the boat to the reef, (b) Mooring Buoy at the snorkeling spot

The total damage to coral reefs in the Karimun Jawa Islands is Rp. 11,175,979.69 per square meter per year due to human activities in the northern coastal waters of Java. This emerged from the results of the 2019 D.D.R.F. (Drive Demand Research Fund) Research on Valuation of Coral Reefs Ecosystem Ecological Services in Karimunjawa National Park conducted by a research team from L.I.P.I. and the Faculty of Fisheries and Marine Sciences,

Diponegoro University, Semarang.

Indonesian Coral Reef Society (I.N.C.R.E.S.) Central Executive Dr. Ir Munasik, Dr. M.Sc, said the results of the ecological valuation show that the value of coral reefs in the Karimunjawa National Park (T.N.K.J.) is Rp. 2,896,813.95/m²/year. According to Munasik, the value of the total loss of damage to coral reefs is primarily determined by the level of natural recovery of the coral reef ecosystem of K.J.J., which varies.

"If the average natural recovery rate of coral reefs in K.J.J. is 26%, then the total loss valuation is IDR 11,175,979.69/m²," said Munasik, a known coral reef expert from Diponegoro University Semarang to Gatra.com. Sunday (17/11)".

Munasik explained that this total value was obtained from the practical shrinkage of restoring the reef ecosystem to 100% in +65 years. The higher the recovery capacity of the coral reef ecosystem in a location, the lower the total loss that must be paid.

"The results of this total loss calculation can be used for claims for damage to coral reefs in the Karimunjawa National Park (T.N.K.J.), and this value can be updated following the inflation of prices for goods and services in the market," said Munasik.

Munasik said coral reefs are one of the most critical ecosystems in tropical waters, acting as food providers from the sea and protecting coastlines. However, coral reef ecosystems are very vulnerable to environmental changes, easily disturbed so that they are easily damaged. "Recently, there have been many incidents of damage to coral reefs in Indonesian waters due to human activities, especially in the waters of the Karimunjawa National Park (T.N.K.J.), which have the potential to harm the environment and humans," he said.

Munasik admits that law enforcement efforts against environmental damage by demanding compensation through field verification have experienced difficulties because the value of coral reef ecosystem services is not yet available. For this reason, said Munasik, it is necessary to study the valuation of the ecological services of coral reef ecosystems in K.N.P. "In this study, the energy analysis method has been applied through ecological modeling in the hope that it can consider aspects of the condition of coral reefs and their environment simultaneously," he concluded. (Karang Karimunjawa Damaged Loss of 11 million per square meter in <https://www.gatra.com/detail/news/457212/hukum/karang-karimun-jawa-rusak-kerugian-11-juta-per-meter-persegi> accessed on June 01, 2022, at 8.20 WIB).

Law no. 32/2009 concerning Environmental Protection and Management stipulates the principle of state responsibility to protect against environmental pollution and damage. The principle of state responsibility ensures the use of natural resources for the welfare of the people, both present and future generations. Normatively, laws and regulations regulate sanctions for perpetrators of environmental violations. Still, in applying the law, there is a lack of unity of action (sectoral ego) because there is no coordination in making policies with related institutions, so dispute resolution becomes complicated. Insufficient legal understanding of state administration officials causes law enforcement to be constrained, and no legal sanctions for officials who fail to carry out their duties give the impression (impression) that the government is not serious about dealing with environmental violations.

As is the case with Karimunjawa National Park, coral reef damage continues to occur due to the lack of unity between the Karimunjawa National Park Office and the local government.

4 Conclusion

Domestic and regional markets have driven the development of the Karimunjawa Islands as a tourist destination. It is promoted as a spot for diving and snorkeling, with the community participating as a provider of tour operator services, tour guides, and accommodation.

Tourist visits that increase yearly raise concerns about the sustainability of tourism activities for the ecological sustainability of coral reefs. Tourism activities in Karimunjawa National Park cause damage to coral reefs. Physical contact with coral reefs is the most frequent by tourists, and physical contact at the three snorkeling spots occurs due to boats mooring on coral reefs and feeding fish. Damage to coral colonies in tourist spots in partial colony death eroded coral colony surfaces and broken branches. The depth of coral reefs that are shallow or accessible to tourists' fins can increase the threat of physical contact by tourists to coral reefs.

Law no. 32/2009 concerning Environmental Protection and Management stipulates the principle of state responsibility to protect against environmental pollution and damage. However, in applying the law, there is an inconsistency between institutions. So, it is like the Karimunjawa National Park, where the damage to coral reefs is still happening due to the inconsistency between the Karimunjawa National Park Office and the local government.

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