

Study Of Snorkeling Marine Tourism Based On Suitability Area And Carrying Capacity In Taman Nasional Kepulauan Seribu National Park, Dki Jakarta

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ABSTRAK: The index of tourism suitability and the carrying capacity of the tourism region is a matter of concern on the management of marine tourism area and need to be developed to reduce the impact of environmental degradation. Therefore the tourist area can be maintained its sustainability. The purpose of this study is to determine the level of tourism suitability and the carrying capacity of marine tourism areas, especially on snorkeling activity spots in three islands of the Thousand Islands National Park, namely Pulau Ratu, Pulau Macan, Pulau Genteng Kayu Angin. The method used is suitability marine tourism area index formula and descriptive method. The result showed the snorkeling tourist suitability tourism index of the three islands on 12 stations showed 5 stations had suitable criteria (S1) and 7 stations conditional suitable criteria (S2). This means that the three islands were still appropriate to be used as a tourist snorkeling area. But if these 12 snorkeling station in the three islands are not managed then there will be damage to the coral reefs. The carrying capacity analysis showed that the value varied according to the spacious area to the tourism area measure that has the suitable criteria (S1) which ranges from 80 to 130 person per day. However based on the number of tourists that exist in 2017, the carrying capacity had exceeded the maximum limit, which is above 150 people / day, meaning it had passed the ability of tourist area to support the number of tourists.

INTRODUCTION

Kepulauan Seribu National Park (KSNP) is a conservation area which has a water area of 107,489 ha located at 5 ° 24'-5 ° 45'S and 106 ° 25'-106 ° 40'E. Based on Government Constitution no. 5 of 1990, this national park area consists of 4 zones, namely Core Zone, Protection Zone, Tourism Utilization Zone and Residential Zone. Tourism Exploitation Zone where is allocated for tourism activities in KSNP is an area of 62,430 ha of waters where there are coral reef ecosystems that become the main attraction for tourism activities in this area (BTNKS 2014). In this zone various tourist activities conducted by the tourists such as diving or snorkeling that is located primarily around the coral reef ecosystem. In addition to these marine tourism activities, several other utilization activities are also conducted around this location, namely fishing activities. However, the most attractive activities are diving and snorkeling. From year to year there is an increase in the number of tourists visiting the KSNP both from home and abroad, which is equal to 15% - 20%. The continuous increasing tourist number can endanger the existence of coral reef ecosystem. Uncontrolled tourist activity can lead to environmental degradation and coral reefs (Terangi 2012). Therefore, it is necessary to conduct research on sustainable marine tourism which relies on the aspects of marine tourism area suitability and carrying capacity. This allows a balance between development programs and the sustainability of natural resources in form of environmentally friendly marine tourism activities.

METHOD

Time and Location

This study was conducted in May 2016 until March 2017 in Kepulauan Seribu National Park area where is being part of Kepulauan Seribu regency administrative area, province of DKI Jakarta. The study location was on the Tourism Utilization Zone, focused on Putri Island, Macan Island and Kayu Angin Genteng Island.

Data Analysis

Marine Tourism Area Suitability

$$IKW = \sum [Ni / Nmaks] \times 100\% \dots\dots\dots(1)$$

Where:

IKW : Marine Tourism Area Suitability Index
Ni : Parameter Value i (weigh x score)
Nmaks: Max Value of a tourism category

The IKW calculation result is compared to the snorkeling suitability matrix (Table 1)

Tourism Area Carrying Capacity Analysis

The method used to calculate snorkeling area carrying capacity referring to the formula from Yulianda (2010) as follows:

$$DDk = Kx \left(\frac{Lp}{Lt} \right) \times \left(\frac{Wt}{Wp} \right) \dots\dots\dots(2)$$

Where:

DDK : Tourism Area Carrying Capacity (person) Daya Dukung Kawasan (orang)
K : Tourist ecology potency per area (person) Potensi Ekologis pengunjung per satuan unit area (orang)
Lp : Area (m²) or Luas area (m²) atau panjang area (m) yang dapat dimanfaatkan
Lt : Area for specific category (m²) or Unit area untuk kategori tertentu (m² atau m)
Wt : Availability hour for tourism activity in 1 day or Waktu yang disediakan oleh kawasan untuk kegiatan wisata dalam 1 hari (jam)
Wp : Spending hour for specific tourism activities or Waktu yang dihabiskan oleh pengunjung untuk setiap kegiatan tertentu (jam)

Table 1. Snorkling Tourism Activity Suitability Matrix

No	Criteria	Weigh	Suitability Class (Score)					
			S1	Score	S2	Score	N	Score
1	Water clarity (%)	5	100	3	50-<100	2	< 50	1
2	Coral reef community cover (%)	5	> 75	3	>50-75	2	<50	1
3	Life form type	4	>12	3	<7-12	2	<7	1
4	Coral reef fish type	4	>100	3	50-100	2	<50	1
5	Speed of current (cm/det)	3	0-15	3	15-50	2	>50	1
6	Depth of coral reef (m)	3	1-5	3	5-10	2	>10	1
7	Width of Coral reef cover (m ³)	3	>500	3	50-500	2	<50	1

Sourcer: Modification of Yulianda (2007) *Note:* S1 : Very Suit; S2 : Suit; N : Not Suit

RESULT AND DISCUSSION

Snorkeling Area Suitability Index

Snorkeling is a marine tourism activity which attract many tourists, because it does not require special skills or certificates. However, if this activity is not well managed, it will give impact on the coral reef ecosystemexistence. Putri Island is one of the marine tourism destination in the Thousand Islands region. Beside its panoramic beauty of the beach and coral reefs, the island also has a resort that became tourist attraction. Therefore, the tourists are attracted to visit this island. The result found that the 12 stations of Putri , Macan and Kayu Angin Genteng Islands showed variability of snorkeling activity suitability level which consisting of not suit, conditional suit, and very suit (table 2). The result showed the general condition of coral reefs in these area which has been much damaged. High utilization rates in recent years were likely to give impact on coral reefs condition. Based on Snorkeling Area Suitability Index (IKW) analysis, to do snorkeling around Putri Island waters obtained two classes of suitability as follows suitable class on ST3 = 68.33%, ST2 = 66.67%, and conditional suitable class on ST1 = 33.33%, ST4 = 27.00% (table 2 and figure 1)). Conditional suitable class on stations 1 and 4, indicated the area was almost not worthy of snorkeling.

This was because of the coral reefs have started to degrade (many broken). It was also seen from the number of lifeforms and reef fishes which were less than the specified requirements, and so do the coral reef cover was included in the bad criteria (below 40%). High marine tourism activities in Putri Island area is caused by a lot of tourists from Putri Island resort and other islands who stop by at the island to do snorkeling. This visits have direct impact on changes in ecosystem around the area, such as damage to coral reefs (rubble) and it degraded. Snorkeling activities that often give impact on the coral reefs damage were kicks from foot fin, standing, kneeling or holding / touching reefs (Webler and Jakowboski 2016).

Table 2. Snorkeling Area Suitability Index on Putri Island

No	Area Suitability Index	Area (m ²)	Location	Index
1	Suit (S1)	28 162	ST3. East	68,33%
			ST2. South	66,67%
2	Conditional Suit (S2)	15 165	ST1. West	33,33%
			ST4. North	27,00%

Source: Resulted Primary Data

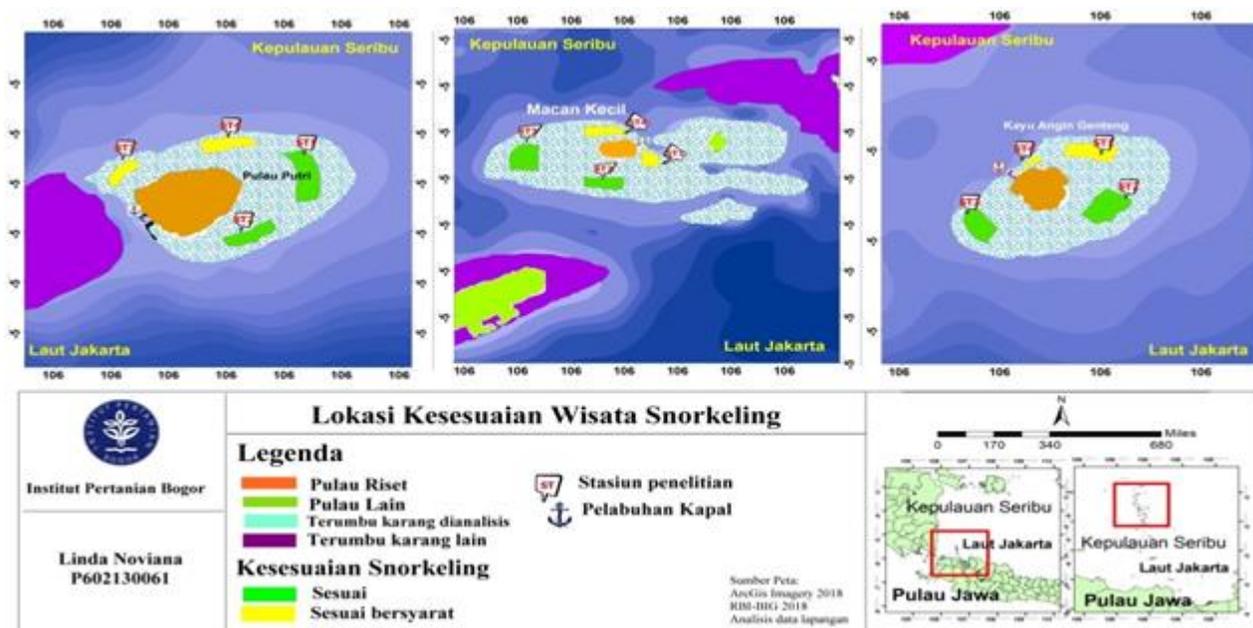


Figure 1. Snorkeling Area Suitability Index on Putri Island

Snorkeling activities, tourist facilities construction, amusement facilities and ease of service for tourists as well were contributors to coral reef damage. Long term tourist transfer between the area and snorkeling or diving spots by the ship owned by the resort manager can cause damage too to the coral reefs due to using anchor boat in these area (Gladstone et al 2013). The impact caused by each tourist behavior on coral reefs was very small, but cumulatively these behaviors can put pressure on coral reefs and affect the percentage of coral cover (Barker and Roberts 2004). Macan Kecil Island is an interesting marine tourism destination and for certain tourists it becomes often a visit target. The enchantment of its sandy coastal landscape has coral reef marine ecosystem with patch reef type of 27.8 ha, supported by a unique seafloor topography, where there are reef flat zones, lagoons and reef slope zones around the island's waters as the potential tourism attraction (CTF 2015). Nevertheless, the result of Snorkeling Area Suitability Index (IKW) analysis was not much different from those in Putri Island. There were two suitability classes, the suitable class was on ST2 = 70.00% and ST3 = 73.33%, meanwhile the conditional class was on ST1 = 31.67% and ST4 = 38.33% (table 3 and figure 1).

Table 3. Snorkeling Area Suitability Index on Macan Kecil Island

No	Area Suitability Index	Area (m ²)	Location	Index
1	Suitable (S2)	20 966	ST3. West ST2. South	73.33% 70.00%
2	Conditional suitable (S3)	10 629	ST1. East ST4. North	31.67% 38.33%

Source: Resulted Primary Data

Based on Snorkeling Area Suitability Index analysis (IKW) of Macan Kecil Island on Table 3, it is known that the location in the west and south is still laying for snorkeling activities. Coral reefs in this area were at a depth of 1.5 - 5 meters, brightness levels of 90-95%, with a steady current velocity between 4 - 5 m / s. Different situation was found on the eastern and northern locations. Although the physical-oceanographic situation was in good condition, the coral reef ecosystems had suffered a significant damage. Therefore this location should not be used as snorkeling resort. It needed also an ecosystem management to be carried through the arrangement of tourist visits and activities control within the station. The results of Snorkeling Area Suitability Index analysis (IKW) on Kayu Angin Genteng Island obtained three classes of Suitability Index where suitable class were on ST2 = 66.67%, ST3 = 65.00% and ST4 = 60.00%, while conditional suitable class were on ST1 = 43.33% (Table 4 and figure 1). Based on the percentage value of live coral cover, it is known that coral reef ecosystems around the waters of Kayu Angin Genteng Island began to experience less damage because of the absence of resorts within the island. There were relatively less tourists who use this area as a marine tourism destination comparing to Putri and Macan Kecil Island. Generally tourists who came were those who transit on Harapan island. Meanwhile the snorkeling spot that belongs to this conditional category (ST1) including the condition is on level of quite severe damage which indicating by a lot of coral fractures around the snorkeling spot. Overall the area for snorkeling in Kayu Angin Genteng Island

based on its suitability level is presented in Table 4 and Figure 1.

Table 4. Snorkeling Area Suitability Index on Kayu Angin Genteng Island

No	Area Suitability	Area (m ²)	Location	Index
1	Suitable (S2)	8972	ST3. West ST2. South	65.00% 66.7%
2	Conditional suitable (S3)	5083	ST4. North ST1. East	60.00% 43.33%

Source: Resulted Primary Data

Based on the value of Snorkeling Area Suitability Index analysis (IKW), it is known that the snorkeling location on the west, south and north parts of Kayu Angin Genteng Island were categorized as layers for snorkeling ecotourism activities. It was supported by the suitability of some oceanographic physics parameters such as good water clarity equal to 90 - 95%, coral reefs were within an ideal depth of 1.5 - 5 meters and a stable current velocity between 4-6 m / s. Therefore, in general these area can be used as a location for marine ecotourism activities. On the east part, it should not be used as a marine tourism site, although it was included in the category of conditional suitable. This choice was taken according to consider that the coral reef ecosystem area at the site began to decrease due to damage which cause by human and natural factors. Marine tourism activities are increasing in recent years and the absence of a proper tourism management concept of this island, can potentially increase damage to coral reef ecosystems around these islands. Marine tourism activities such as snorkeling and diving have the potential to impact directly the coral reef degradation (Millazo et al 2002). Based on field observation on coral reef ecosystem at depth of 1.5 - 5 meter on all three study islands, it is known that these coral covers have decreased due to several factors, among others human and natural factors. The impact of this biggest degradation was caused by human factors, it was shown that many coral reefs that were ruptured (rabble). Marine tourism activities which have increased in recent years, tend to make impact on coral reefs ecosystem. The damage on the coral reefs (rubble) due to tourism activities conducted by snorkeling tourists through direct contact, where some tourists deliberately stop and stand on the coral reefs. The most frequent behavior that caused coral reef damage during snorkeling was caused by fin contacts by tourists. This behavior added to cause coral colon to be broken, also close coral polyp due to sediment stirring at bottom of water. In addition, the impact of this damage was higher due to destructive fishing activities in irresponsible ways by using fish bombs and potassium cyanide. As well as taking fish and ornamental coral reefs were still common (Webler and Jakubowski 2016; Faisal et al 2012) Snorkeling tours become one of the tourist attractions that are in great demand and can be done by many people, because it does not require special skills such as diving tours. The ideal water depth for snorkeling tours is at a depth of 3 - 5 meters. On the other hand, the ecosystem damage also occurs due to global weather changes in recent years. The NOAA report in March 2016 regarding the warning of extreme temperature rise potential in some waters area in the world especially in Indian Ocean region. Indonesia became one of the countries affected by the phenomenon.

Reports in the form of documentation drawings from various sources show the condition of white coral reefs in the period April to July 2016 along the west coast of Sumatra to southern Java, Bali and Nusa Tenggara (Siringoringo et al., 2017).

Marine Ecotourism Area Carrying Capacity

According to (Jurado et al 2012) the carrying capacity of an area is its ability to support marine tourism activities in certain area, related to human activities, by considering other natural resources and the balance between among them. Furthermore, this concept should consider the ecological concept such as natural resources sustainability which means the natural ability to tolerate the disturbance of human activities, and as well the standard of satisfaction in enjoying the natural resources as a whole without any interference from other visitors. Based on IKW analysis results on 3 islands consisting of 12 stations, only 7 stations are eligible or included in the appropriate class which can be calculated carrying capacity, ie 2 stations on Putri Island, 2 stations on Tiger island and 3 stations on Kayu Island Wind Tile. Five other stations that enter the class according to the conditional can not be calculated carrying capacity. Calculation of carrying capacity indicated that all stations entered in the suitable category (7 stations), also the value of its carrying capacity was above the proper carrying capacity. This means that all snorkeling spots have exceeded the limits of existing support capability. This was due to the increasing tourist spikes without good control. In Putri Island, the location used for snorkeling tourism area was 28 162 m² (2.8 ha) with a limitation of the number of tourists by 113 people / day. On Macan Kecil Island, the location used for snorkeling tourism area was 20 966 m² (2.09 ha), and the ideal visitor limit of 84 people / day. For snorkeling suitability area at Kayu Angin Genteng Island was 8972 m² (0.8 ha), with the limitation of 36 tourists / day. The result of area carrying capacity analysis on the three islands can be seen in (Table 5).

Table 5. Snorkeling Area Carrying Capacity

Island	Area(m ²)	CC (person/day)	Real (person/day)	DD (person/day)
Putri	28 162	113	256	
Macan Kecil	20 966	84	160	
Kayu Angin Genteng	8972	36	87	

Source: Resulted Primary Data

Table 5 showed all the stations which were included in the category suitable area and had already exceed the limit of carrying capacity. One of the means for marine tourism areas management to be sustainable it would be advisable to restrict tourists who enter the area by raising tariff or entrance fee area. The area of marine ecotourism carrying capacity calculation (DDK) was done based on the characteristics of the resource and its allocation for activities type. This calculation was based on the idea that ecosystems within an area have maximum capacity to support organism life and are able to accept the surrounding activities (Jurado et al 2012). The number of tourist arrivals on each of three islands was relatively different but it increased generally. Marine tourism activities on the three islands, generally took place every day, but it increased every weekend, if the

appeal is normal day. Especially when entering a long holiday and religious holidays, tourists number who came became triple than normal weekend days. Tourists generally come from Jakarta and its surrounding areas such as; Bogor, Depok, Tangerang and Bekasi, although some came from outside and abroad, but the number was relatively small. Tourists came in groups of 2-5 people or 5-10 people and in a larger group > 10 people. Generally the tourist visited by using travel agency service that had determined the number of tour packages according to price and number of groups.

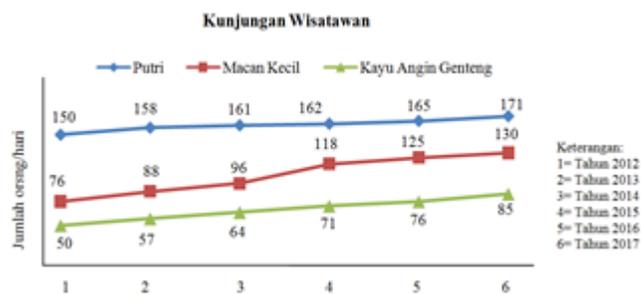


Figure 2. The number of tourists visits every day during year 2012-2017

Based on Figure 2, data analysis of tourist visits activities in Putri, Macan Kecil and Kayu Angin Genteng Islands, it shown that there was tendency of increased tourist arrivals during the period of 2012 - 2017. Increased tourist visits differed on each island, but it significantly increased clearly seen on Little Tiger Island. Since the last six years, the percentage of tourists increased from 1.7% (76 persons / day) in 2012 to 5.0% (130 persons / day) in 2017. Likewise the percentage of tourist arrivals on Kayu Angin Genteng Island experienced an increasing trend of tourist visits. The third status of the island as a tourism utilization zone within the Thousand Islands TNL, does not provide restrictions on tourists who come. This condition is an anomaly in the context of the status of an island is very small with a variety of special characteristics and limitations of natural resources. The increase of tourist arrivals in 2012 by 0.7% (50 persons / day), increased to 2.1% (85 persons / day) in 2017, this is a significant increase in form, considering the characteristics of Kayu Angin Genteng island with land area < 1 km² and eco-geographic islands connected with several other small islands in the Marine National Park core zone of Kepulauan Seribu. In contrast to the percentage of tourist visits on Putri Island during the last six years, based on data obtained by the trend of increasing tourist arrivals from 2012 to 2017, it did not experience significant, the increase was relatively small with a percentage between 6.7% - 8.7%, but the percentage of existing, known tourist arrivals in the island of Princess was greater when it was compared to tourist visits on the Macan Kecil and Kayu Angin Genteng Island. This difference occurred because Putri Island is one of the islands in the Thousand Islands group that has long been opened and used as a marine tourism destination. Therefore, it has known, that the concept of marine tourism management opens to every circle and many tourist ride that become tourist attraction. Based on the data of tourist arrivals obtained on Putri, Macan Kecil and Kayu Angin Genteng Islands have entered an alarming level. In general the number of tourist visits is above 50% of carrying capacity (carrying capacity) for snorkeling ecotourism activities. Even

on Macan Kecil Island and Kayu Angin Genteng Island, this amount is almost close to the optimum support capacity for ecotourism activities. The management of snorkeling and diving ecotourism on Putri, Macan Kecil and Kayu Angin Genteng Islands, needs to be seen as a single very small island ecosystem within the Kepulauan Seribu group, through ecosystem approaches with vulnerability-based management and resilience to prevent disturbance in undesirable ecosystems due to utilization pressure and maintains elements in ecological systems, so as to update and rearrange the damage to existing ecosystems (Gladstone et al., 2013). Therefore, it is necessary to rearrange the marine tourism activities comprehensively from facilities, infrastructures, tourism rides to the ideal management concept, so as to maintain the ecosystem and sustainability of natural resources. Particularly on Pulau Kayu Angin Genteng, it is necessary to socialize the community (tourists) in relation to its status as a core zone and increase supervision around the island, so that it not only brings economic benefits but is capable of sustaining the natural resources and ecosystem. This is in line with Holling's (1973) explanation that sustainable economic activity can be achieved when life-supporting ecosystems are in sustainable condition.

CONCLUSION

1. Snorkeling tourism index on 3 islands of Thousand Islands National Park consisting of 12 stations have varying values, 7 stations including the corresponding class and 5 classroom entry stations according to conditional.
2. Snorkeling tourism area on three islands (12 stations) all were have exceeded the capacity of snorkeling marine tourism area

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