Status of area suitability for coastal tourism in east coast of Weh Island Marine protected area Sabang, Aceh

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Abstract. The objective of this study is to determined the status and tactical decisions priority of area suitability for coastal tourism in East Coast of Weh Island (PTPW) Marine Protected Area. Types of data sources used in this study were primary data and secondary data, where the primary data is data obtained through direct measurement and interview, secondary data is the data obtained from second party. Data were processed and analyzed by qualitative and quantitative methods, and Tourism Suitability Index (IKW). Assessment of the area suitability for marine tourism, showed that Anoi Itam and Sumur Tiga are suitable to be used as diving and snorkeling areas.

1. Introduction

Tourism activities are one of the contributors that can have a negative impact on the environment [1], marine tourism activities continue to increase in the last few decades, so that the direct impact on marine habitat is also expected to increase [2]. The development of facilities and infrastructure to support tourism activities, fishing, pollution and sedimentation activities, and marine tourism activities such as snorkeling and diving also contribute to the deterioration of the carrying capacity of an environment [3]. Marine tourism activities such as diving and snorkeling often have a detrimental impact on the coral reef ecosystem [4]. Fisheries and marine tourism activities can directly or indirectly damage coral reefs [5]. Fisheries management and the establishment of conservation areas are important because there have been many studies that state that the reserves of marine natural resources tend to decrease over time [6]. Marine protected areas were originally formed to reduce the negative impacts caused by human activities [7]. The PTPW Marine Protected Area has the potential for high diversity of coral reefs and reef fishes. The type of coral reef morphologically is fringing reef. The type of coral in this region is dominated by Acropora, Porites, Pocillopora and Heliopora [8]. Based on the results of the Wildlife Conservation Society / WCS [9] survey, coral reef cover in the PTPW is spread in a number of villages, with each of the following: 58% Anoi Itam, 61% Fortress, 25% Reuteuk, Sumur Three 75% and Ujung Kareung 68%. The high percentage of coral reef cover makes this area as habitat and stock for reef fishes with high diversity. The high diversity of coral reefs and reef fish opens marine tourism opportunities in the PTPW, tourism activities have a very

positive influence on the economic growth of Sabang City [10]. As a preliminary study, development planning was carried out to determine the suitability of the area to become a marine tourism area, so that analysis of tourist suitability was needed using the Tourism Suitability Index (IKW).

2. Material and Methods

The study was conducted in January-April 2018 in the Anoi Itam and Sumur Tiga, Marine Protected Area, Sukajaya, Sabang City. The types of data sources used in this study are primary data obtained through direct measurements and interviews, secondary data obtained from other parties and in this study is research data from Najmi [11]. Secondary data used in this study are data on coral reefs and reef fish. Data is processed and analyzed qualitatively and quantitatively. Data of water quality, coral reef status, reef fish species and several tourism suitability variables were taken at Anoi Itam and Sumur Tiga. Area suitability for marine ecotourism is a criteria of resources and environment required or needed for the development of marine ecotourism. The type of data in this study are primary and secondary data. Primary data is obtained directly by using survey techniques and interviews. Area suitability assessment is conducted to determine the suitability status of an area to be used as a tourism place (diving and snorkeling). The stages of this research assessment can be seen in Figure 1.

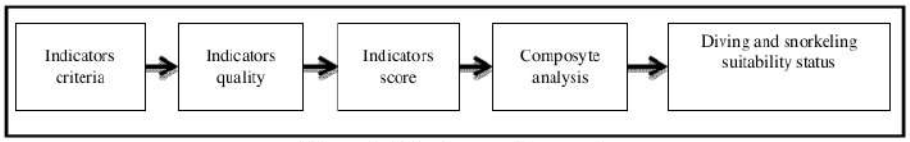

Figure 1. The stages of research

Analysis of area suitability for diving and snorkeling tourism can be seen in Table 1.

Table 1. Analysis of area suitability for diving [12]

Indicators	Quality	Criteria	N (Quality × Score)
Waters brightness	5	0 = <20 % 1 = 20-50% 2 = 50-80% 3 = >80%	
Coral cover	5	0 = <25 1 =25-50 2 = 50-75 3 =>75	
∑ Coral *life form* species	3	0 = <4 1 = 4-7 2 = 7-12 3 = >12	
Reef fishes species	3	0 = <20 1 = 20-50 2 = 50-100 3 = >100	
Current velocity	1	0 = >50 cm/det 1 = 30-50 cm/det 2 = 15-30 cm/det 3 = 0-15 cm/det	
Coral depth	1	0 = <3m dan >30m 1 = 20-30 m	

	2 = 3≤6 dan 5≥20 3 = 6-15 m	
∑ N =		
∑ N_{max}=		54
IKW		

The IKW value (area suitability index for tourism) in diving is formulated as follows:

$$IKW = \sum_{i=1}^{n} \left[\frac{N_i}{N_{maks}}\right] \times 100\%$$

Informations:
IKW = area suitability index for diving
N_i =parameters number to – i (quality × score)
N_{maks} = Maximum number of diving category =54
That suitability category is 3 2]:
S1 = very appropriate, IKW 83-100%
S2 = appropriate, IKW 50-83%
N = not appropriate, IKW <50%

Table 2 is a table that explains the area suitability for snorkeling, the difference in analysis of the two marine tourism activities because not all regions can be used as diving and snorkeling attractions together.

Table 2. Analysis of area suitability for snorkeling[12]

Indicators	Quality	Criteria	N (Quality × Score)
Water brightness	5	0 = <20 % 1 = 20-80% 2 = 80-100% 3 = 100%	
Coral cover	5	0 = <25 1 =25-50 2 = 50-75 3 = >75	
∑ *Coral* life form species	3	0 = <4 1 = 4-7 2 = 7-12 3 = >12	
Reef fishes species	3	0 = <10 1 = 10-30 2 = 30-50 3 = >50	
Current velocity	1	0 = >5 8 cm/s 1 = 30-50 cm/s 2 = 15-30 cm/s 3 = 0-15 cm/s	
Coral depth	1	0 = 10 ≤ 1 1 = 6-10 m 2 = 3-6 and 3 = 1-3 m	

Coral width	1	0 = <20 m 1 = 20-100 m 2 = 100-500 m 3 = >500 m	
∑N =			
$\sum N_{maks}$=			57

IKW index on area suitability for snorkeling tourism can use formulas [12]:

$$IKW = \sum_{i=1}^{n} \left[\frac{N_i}{N_{maks}}\right] \times 100\%$$

Informations:

IKW = Area suitability index for snorkeling
N_i =Parameter number to– i (quality x score)
N_{maks} = maximum number for snorkeling =57

The category of area suitability for snorkeling tourism has been determined and can be used for this analysis. The suitability categories are as follows [12]:

S1 = very appropriate, IKW 83-100%
S2 = appropriate, IKW 50-83%
N = not appropriate, IKW <50%

3. Results And Discussions

In this study, tourism suitability status was observed as a reference for the Sabang government for development planning marine tourism areas. The tourism suitability observed was suitability for diving and snorkeling marine tourism at Anoi Itam and Sumur Tiga. Based on the research of Najmi [11], the percentage of coral reef cover in Anoi Itam and Sumur Tiga were 47.4% and 48.3%, respectively. The number of types of coral reef life form in Anoi Itam is 7 types, in Sumur Tiga 11 types. Coral fish species in Anoi Itam and Sumur Tiga are 57 species and 70 species respectively. The data is then used for area suitability assessment for marine tourism.

3.1. Suitability of the area for diving and snorkeling tourism at Anoi Itam

The results showed that Anoi Itam is suitable if used as a diving and snorkeling tourism location. The IKW value obtained for diving tours at Anoi Itam is 64.81, while the IKW value for snorkeling tours is 64.81. The indicator that gives the greatest value in this assessment for diving tourism is the water brightness indicator with a value of 15, water brightness is very supportive of diving tourism activities, so this indicator is very important for planning the location of marine tourism. The percentage of coral cover is also an important indicator, but in the assessment at Anoi Itam this indicator only has a value of 5, because coral reef cover does not reach 50%. The area suitability assessment for diving in Anoi Itam can be seen in Table 3.

Table 3. The area suitability assessment for diving tourism in Anoi Itam

Indicators	Results	Scores	Quality	Value
Water brightness	100%	3	5	15
Coral cover[11]	47,4%	1	5	5
Reef fishes species [11]	57 types	2	3	6
Current velocity	2,31 cm/s	3	1	3
Coral depth	8-12 m	3	1	3
IKW				64,81
INFORMATION				APPROPRIATE

The IKW value obtained for snorkeling tourism at Anoi Itam is 64.81, so this area is suitable for snorkeling. Like the diving tourism suitability assessment, the water brightness indicator gives the highest score. The results of the assessment of snorkeling tourism in Anoi Itam can be seen in Table 4.

Table 4. The area suitability assessment for snorkeling in Anoi Itam

Indicators	Results	Scores	Quality	Value
Water brigthness	100%	3	5	15
Coral cover [11]	47,4%	1	5	5
Coral life form species [11]	7 types	1	3	3
reef fishes species [11]	57 types	2	3	6
Current velocity	2,31 cm/s	3	1	3
Coral depth	8-12 m	3	1	3
Coral width	133,16 m	2	1	2
	IKW			64,91
	INFORMATION			APPROPRIATE

3.2. Suitability of the area for diving and snorkeling tourism in Sumur Tiga

The results of the observation show that the Sumur Tiga are suitable for diving and snorkeling tourism areas, with IKW values of 70.37 and 71.92 respectively. The area suitability assessment for diving tourism in Sumur Tiga is higher than Anoi Itam.Area suitability assessment for diving tourism can be seen in Table 5.

Table 5. Area suitability assessment for diving tourism in Sumur Tiga

Indicators	Results	Scores	Quality	Value
Water brightness	100%	3	5	15
Coral cover [11]	48,3%	1	5	5
Reef fishes species [11]	11 jenis	2	3	6
Current velocity	70 jenis	2	3	6
Coral depth	1,97 cm/det	3	1	3
Water brightness	7-10 m	3	1	3
	IKW			70,37
	INFORMATION			APPROPRIATE

The results showed that in addition to being suitable to be a diving tourism area, Sumur Tiga is also suitable if used as a snorkeling tourism area. Table 6 is a table about the assessment of snorkeling tours in Sumur Tiga.

Table 6. Area suitability assessment for snorkeling tourism in Sumur Tiga

Indicators	Results	Scores	Quality	Value
Water brigthness	100%	3	5	15
Coral cover [11]	48,3%	1	5	5
Coral life form species [11]	11 jenis	2	3	6

reef fishes species [11]	70 jenis	3	3	9
Current velocity	1,97 cm/det	3	1	3
Coral depth	7-10 m	1	1	1
Coral width	109,62	2	1	2
IKW				71,92
INFORMATION				APPROPRIATE

4. Conclusion

Area suitability assessment for marine tourism using the tourism suitability index (IKW), shows that Anoi Itam and Sumur Tiga are suitable to be used as diving and snorkeling tourism areas.

Acknowledgement

It is necessary to conduct research on IKW periodically, to find out the development of fisheries management status in PTPW conservation areas.

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