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TOURISM CARRYING CAPACITY TO SUPPORT BEACH MANAGEMENT AT TANJUNG BIRA, INDONESIA

DAYA DUKUNG WISATA UNTUK PENGEMBANGAN MANAJEMEN PANTAI DI TANJUNG BIRA, INDONESIA

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ABSTRACT

Tourism carrying capacity assessment for the protection of coastal area was applied to Tanjung Bira beach as an attempt to assess the optimum allowable number of visitors in accordance to the PAOT (people at one time approach) without damaging the surrounding ecological, social and cultural environments. The study shows that the Real Carrying Capacity (RCC) was 202 beach user/day and the Effective Carrying Capacity (ECC) was 117 beach user/day. Although there was a significant difference between Physical-Ecological and Social-Cultural Carrying Capacity, this study suggests that the Physical-Ecological Carrying Capacity or Real Carrying Capacity may be applied for ecosystem management, whilst the Social-Cultural Carrying Capacity or Effective Carrying Capacity (ECC) may be addressed when management objectives are tourists and beach user.

Keywords: beach management, carrying capacity, Tanjung Bira.

ABSTRAK

Estimasi daya dukung wisata untuk perlindungan kawasan pantai untuk diterapkan ke Tanjung Bira sebagai upaya untuk menilai jumlah pengunjung yang diperbolehkan secara optimum sesuai dengan pendekatan PAOT (people at one time) tanpa merusak lingkungan ekologi, sosial dan budaya di sekitarnya. Hasil penelitan ini menunjukkan bahwa Real Carrying Capacity (RCC) adalah 202 pengguna pantai/hari dan Efektif Carrying Capacity (ECC) adalah 117 pengguna pantai/hari. Meskipun ada perbedaan yang signifikan antara Daya Dukung Fisik-Ekologi dan Sosial-Budaya, penelitian ini menunjukkan bahwa Daya Dukung Fisik-Ekologi atau Real Carrying Capacity (RCC) dapat diterapkan untuk pengelolaan ekosistem, sementara Daya Dukung Sosial-Budaya atau Efektif Carrying Capacity (ECC) dapat diatasi ketika tujuan manajemen adalah wisatawan dan pengguna pantai.

Kata kunci: manajemen pantai, daya dukung, Tanjung Bira.

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INTRODUCTION

Tourism potential of a beach has proven to be able to push the economic growth by its contribution to national income from many countries (Das & Chatterjee, 2015). This is due to the overall tourism growth that directs people to the beach to enjoy the nature, recreation, escape from city crowds and for relaxation (Vaz *et al*., 2009). Miami Beach is the example of tourism potential beach, the tourism value was US $2.4 billion annually and Florida also contributed to the state about the US $65 billion in foreign exchange (Houston, 2002); Barbados beach tourism worth > US $13 million to the local economy (Dharmaratne & Braithwaite, 1998).

One of the tourist destinations in South Sulawesi after Tana Toraja Regency is Bulukumba Regency. The area, which is located in the southern region of South Sulawesi, has the potential of attractions that can be superior in South Sulawesi. Potential tourism objects in Bulukumba Regency consist of marine and island tourism such as Tanjung Bira white sand beach, Marumasa Bira beach, Lemo-lemo white sand beach, Mandala Ria white sand beach, Samboang beach, Panrang Luwu beach, Caseo beach, Merpati/Leppe'E beach, Liukang Loe island and Kambing island. According to Bulukumba District (Indonesia) increased revenue from beach tourism worth US $12,321 in 2009, US $14,162 in 2010, US $ 16,698 in 2011, and US $17,107 in 2012 (Department of Culture and Tourism of Bulukumba District, 2012).

Management of coastal tourism has become not only a matter of resource management but also community management from their activities and preservation of the coastal region aspect. Carrying capacity concept can be an alternative to coastal management. Carrying capacity is defined as the maximum number of people that may visit a tourism destination at the same time, without causing destruction to the environment or decreasing in the quality of the visitor satisfaction (Chung, 1988; Davis & Tisdell, 1996; Liu, 2003; Wall & Mathieson, 2006). Establishment of beach ecotourism which considers the carrying capacity of the area can assist the management of the negative impact arising from the activities of recreation (Silva, 2002). In addition, Segrado *et al*. (2008) pointed out that the concept of carrying capacity can elaborate various factors that limit the growth of tourism, carrying capacity concept may also be supported as a replacement tool for managing the flow of tourism to the destination area. While Bonilla & Bonilla (2009) indicated that this concept should be seen as a positive and dynamic prism contemplating the temporal space as a basic value for the implementation of sustainable beach management principles.

The challenge is how to integrate the needs of all coastal zone stakeholders in the sustainable planning process which considers environmental, socio-economic and cultural dimensions (Kanji, 2006). In this case, the harmonious relationship between ecotourism performer and an environment that must be created with suitable management (Bunruamkaew & Murayama, 2011). In the application of optimized and effective planning and management, it takes the concept of carrying capacity ecotourism to provide biophysical and social conditions that are desired (Sayan & Atik, 2011). The Introduction of analysis methods of Limit of Acceptable Change (LAC) as the method used in calculating carrying capacity with environmental indicators and recreation indicators tries to solve these problems (Simon *et al*., 2004). However, a reliable and well-designed environmental monitoring program continues was necessary (Buckley, 1999).

METHODOLOGY

Study Area

This research was conducted at the Tanjung Bira beach, located in Bulukumba District, South Sulawesi (Figure 1). It is in the south of the Sulawesi island, and about 153 kilometres from Makassar. This beach is located at 5°36'58,76" S-120°27'24.15"E and is the most popular tourist location in the district of Bulukumba. Tanjung Bira beach has a coastline of the 3.1 km, reaching a width of 5 m, the depth of the coast range 1-2 m, slope of the beach no more than 2.5°, brightness 100% of the ocean, the speed of the flow 0.15 m/sec, the vegetation in the form of coconuts and open land, and there are no dangerous sea life and the white sand with finer substrates (Putera *et al*., 2013).

As the result, an increase in the number of tourists each year (Table 1) which may threaten the sustainability of the tourist area, so that the right action is required for the beach conservation and management to overcome this. The object of this research is focused on beach user. Therefore, this study was conducted to measure the optimum number of beach user can be tolerable in accordance with the value of tourism carrying capacity.

Data Collection

Determination of tourism use of space was approached by observing the arrival time and the return of tourists, type of activities performed in the beach user a frequency of activity, number of beach user (group or individual), measuring the area occupied by tourist, then mapping coastal regions (Maryono, 2017). The observation of activities was divided into 3 time periods, Period I 07:00-10:00 pm, Period II 10:00-14:00, period III 14:00-17:00. Observations of the users of the beach or tourists were done on a regular day type (Low Visit) with two days of observations of each week, and the weekend that is Saturday (Condensed

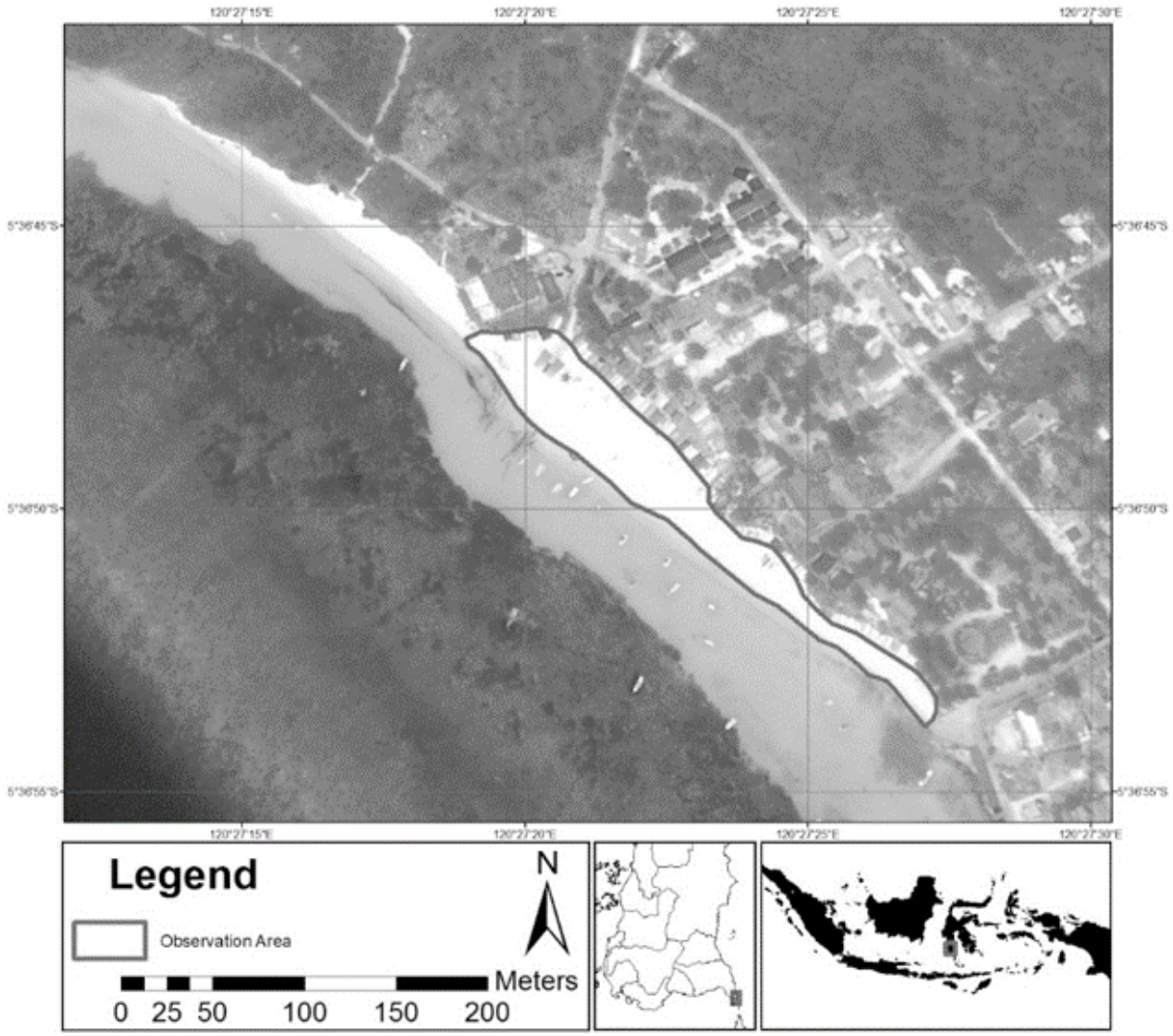

Figure 1. Map of the study area. Image from Google Earth.

Table 1. The number of foreign and local tourists

Year	Tourist Number		Total
	Foreign	Local	
2011	2,500	87,000	89,500
2012	2,940	98,030	100,970
2013	3,425	115,343	118,768
2014	4,120	137,087	141,207
2015	3,680	156,770	160,450

Source: Department of tourism and culture of Bulukumba District, 2015

Visit) and Sunday are generally being the culmination of a tourist visit (Peak Visit) for 30 days.

Carrying Capacity Assessment

This theory was developed by Cifuentes (1992), then applied by several other authors like Segrado *et al*. (2008) and Zacarias *et al*. (2011) that in order to determine the maximum number of visits (tourist) based on the physical, biological and management conditions of the area. To apply this method, it is important to consider tourist flows, the size of the area, the optimum space available for each tourist to move freely and the visiting time (Cifuentes, 1992). Based on that description, the physical carrying capacity (PCC)

was determined by the equation (1):

$$PCC = \frac{A}{A_u} \times R_f \quad \text{..... 1)}$$

where PCC is the physical carrying capacity, A is the available effective area for public, Au is the available area per user and Rf is the rotation factor or a number of visitors per day allowed to a location which is calculated as Rf = operational time/average visiting time in one visit.

Real Carrying Capacity (RCC) according to Cifuentes (1992) is the maximum limit of visits determined from PCC of a region. The following calculation formula is:

$$RCC = PCC \times Cf_1 \times Cf_2 \times \ldots Cf_n \quad \text{..... 2)}$$

where RCC is the real carrying capacity, PCC is the physical carrying capacity and Cf is the correction factors with the following formula:

$$Cf_x = 1 - \frac{Lm_x}{Tm_x} \times 100 \quad \text{..... 3)}$$

where Cf is the correction factors of the variable x, Lmx is limiting magnitude of variable x and Tmx is the total magnitude of the variable x. The correction factor (Cf) used is strong winds, rainfall, the sunshine, the temporary closure and the beach erosion, all chosen because restricting tourism activities, use of facilities and measurement of the level of sustainability of tourist destinations (Zacarias *et al*., 2011).

Effective Carrying Capacity (ECC) is the maximum number of visits that are able to fit the area. The following equations of power support effective (ECC):

$$ECC = RCC \times MC \quad \text{..... 4)}$$

where ECC is Effective Carrying Capacity, the RCC is Real Carrying Capacity and MC is management capacity. The value of management capacity (MC) is determined based on the use of the infrastructure, services, and facilities available, the satisfaction of tourists and evaluation during the survey period (Sousa *et al*., 2014).

RESULTS AND DISCUSSION

Results

Physical Carrying Capacity (PCC)

For the calculation of the Physical Carrying Capacity (PCC) on the beach area only which was observation around 23,050 m^2 and the effective area can use by beach user around 20,260 m^2. There are 6 categories of common activities done by the beach user, that are taking photos, sit back, beach sports, sunbathe, play sand and walking on the beach. There are 6 categories of common activities done by the beach user, that are taking photos, sit back, beach sports, sunbathe, play sand and walking on the beach. Based on the frequency of occurrence of the activities performed on the Tanjung Bira beach, then obtained an average of extensive use of space per beach user, Au = 18.6739 m^2 (Table 2). The rotation factor (Rf) was obtained from the results of the division between operational time (11 hours) and the average visiting time in one visit (5.3 hours) and the rotation factor value was 2.0755. So that, the PCC was estimated to be 2,257 beach user/day.

Real Carrying Capacity (RCC)

For the calculation of the Real Carrying Capacity, there are 5 correction factors. Data for this parameter was obtained from papers published regarding the beach, especially from Indonesian Agency for Meteorological, Climatological, and Geophysics, European Centre for Medium-Range Weather Forecasts, Google Earth, and paper report of Department of Culture and Tourism of Bulukumba. Based on this, the RCC was estimated at 202 beach user/day. The following calculation results (Equation 3):

Table 2. Extensive use of space per beach user for each beach activities

Activities	Number of Visitor	Total of Frequency	Area (m^2)
Taking photos	2,658	518	2.0338
Sit back	557	137	1.0604
Beach sports	609	90	2.9662
Sunbathe	35	21	1.7672
Play sand	580	170	2.9485
Walking on the beach	728	202	5.3553
Swimming	1,462	185	2.5423
Total of extensive use of space per beach user (m^2/user)			18.6739

Rainfall. Bulukumba District has a tropical climate that is marked by the presence of two seasons, namely rainy season and dry season. The rainy season is from October to April and the dry season lasted from April to October. Based on data from Indonesian Agency for Meteorological, Climatological, and Geophysics, monthly rainfall (mm) in the area of Bulukumba District in 2009-2015, there are 3 months (May, June and July) with the highest rainfall of more than 350 mm. Hence, limiting the size of the variable (Lm1) to the parameter of the rainfall is 92 days, while the number of variable sizes (Tm1) is 365 days. Based on the results of the calculations, correction factors for rainfall is 0.6712 or 67.12%.

Strong Winds. This parameter was included as it can largely influence the recreational satisfaction of people on the beach by transporting a large amount of sand. Based on data taken from the site of European Centre for Medium-Range Weather Forecasts with 18 stations for data retrieval speed of the wind in the afternoon for 1 year (2015) stated that on July, August, September, and October the wind speed is high enough. Therefore, limiting the size of variable strong winds (Lm_2) is 123 days and the number of the variable size of the strong winds (Tm_2) was 365 days. Based on the results of the calculations, correction factors for this parameter is 0.6658 or 66.58%.

Sunshine. This can be the most important parameter for beach tourism as without the sunshine few people go to the beach for recreational activities. Based on the data length of the sun shines from Indonesian Agency for Meteorological, Climatological, and Geophysics in 2009-2014, that on average the sun shines long was 61% or 6.5 hours/day then the sun shines long for 12 months, namely 365 days x 6 hours = 2,226.5 hours/year. Hence, limiting the size of the variable Sun does not shine (Lm_3) for 6533.5 hours/year number of variable size and the Sun does not shine (Tm_3) for 8,760 hours/year. Therefore, a correction factor for this parameter is 0.2542 or 25.42%

Beach erosion. This parameter is very important in the management of coastal tourism because it reduces available the space for recreation. Based on the result of the overlay analysis on the Google Earth image data from 2006-2014, it may be assumed that Tanjung Bira beach loses 777 m^2/year (2.1 m width x 370 m long). Therefore, the limiting factor was determined (Lm_4) as 777 m^2, the total magnitude was total area of the beach (Tm_4) as 20,260 m^2 and correction factors of the calculation result is 0.9617 or 96.17%.

Temporary closure. Safety for users of the beach becomes one of the important factors for Management. Tanjung Bira beach rarely closes temporary, unless the high waves that often occur in December, January, February, and March. As a result, the beach filled with garbage which swept to the mainland. Head of Department of Culture and Tourism of Bulukumba District usually closes tourist location in February to March to do the cleaning. Limiting the size of the variable (Lm^5) for this parameter was 61 days, whereas the number of variable sizes (Tm^5) is 365 days. Correction factors based on the results of the calculations is 0.8329 or 83.29%.

Table 2. Indicators and Management Capacity applied to assess the Effective Carrying Capacity at Tanjung Bira beach (modification from Sousa et al., 2014)

Indicators	Classification			Tanjung Bira beach
	Low (1)	Medium (2)	High (3)	
Parking	Absent	Little	Adequate	2
Presence of domestic animals	Frenquent	Moderate	Absent	2
Public bathrooms	Absent	Little	Adequate	1
Public benches	Absent	Little	Adequate	1
Coast guard	Absent	Little	Adequate	1
Announcement board	Absent	Little	Adequate	2
Cleanliness of the beach	Not clean	Clean enough	Clean	2
Waste bins	Absent	Little	Adequate	2
Public toilets	Absent	Little	Adequate	2
Accomodation	Absent	Little	Adequate	2
Bar and restaurant	Absent	Little	Adequate	2
Accessibility	Absent	Little	Adequate	2
Street lighting	Absent	Little	Adequate	2
Place of worship	Absent	Little	Adequate	1
Safety	Absent	Little	Adequate	2
	∑			26

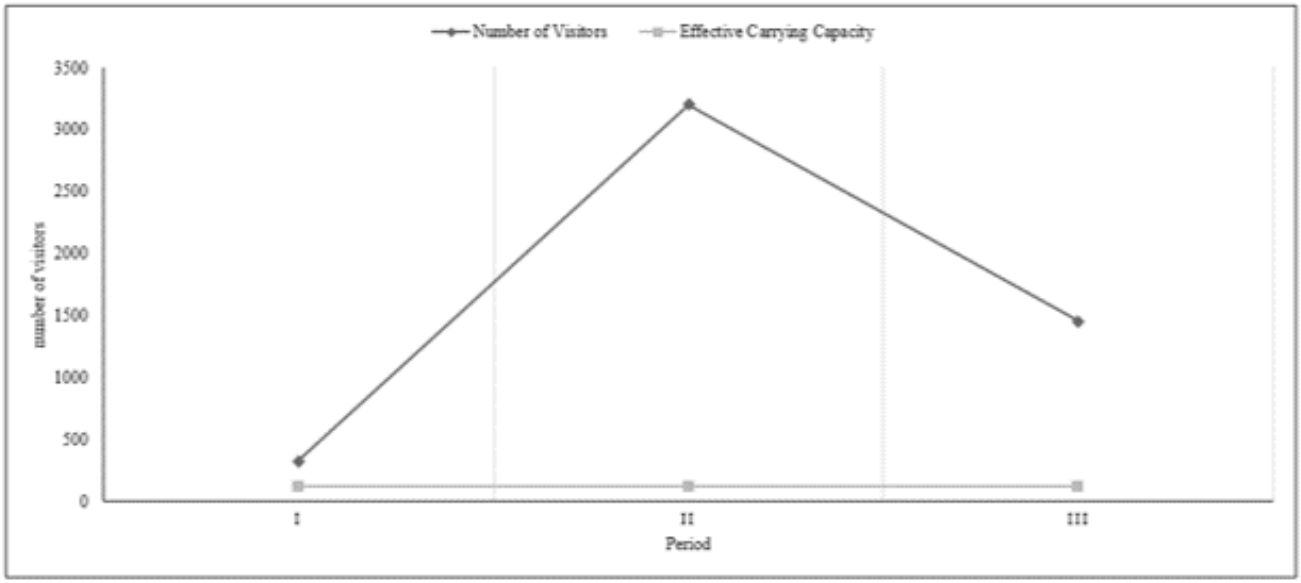

Figure 2. Number of visitors in Peak Visits.

Effective Carrying Capacity (RCC)

Based on the result that the Effective Carrying Capacity was estimated to be 117 beach user/day, management capacity recorded for Tanjung Bira beach (Table 3) indicated that Tanjung Bira has only 58% of an existing condition, the infrastructure, services and facilities available, satisfaction of tourists and evaluation necessary for supporting beach management.

Discussion

The constraints in managing the carrying capacity are difficult to calculate the maximum number of visitors during the peak season, daily, weekly and yearly in detail, the absence of tourists to visit, and facilities and infrastructure are inadequate when increasing numbers of travellers (Chougule, 2011). Therefore, the calculation capacity in a tourist attraction, had to be done, because according to the concept of green tourism that more emphasis on sustainability.

The results of the calculation of the value of physical carrying capacity (Equation 1) was 2,257 beach users/day. That's mean, the maximum number of capacity per day can be tolerated by a tourist area and showed the importance of factor rotations as the control for the development strategy of tourism management of the beach. The calculation result from the (Equation 2) value of real carrying capacity estimated 202 beach user/day. The facts in the field were the number of tourists visiting approximately 3000 people on a Sunday (peak visits) (Figure 2). If at the same time, tourists to the beach may be the optimum carrying capacity exceeds the limits of real support. In the future, if not applied the policy or regulatory limitation of the beach user, it would have an impact on the sustainability of the coastal area.

Effective carrying capacity was estimated 117 beach users/day. As suggested by Cifuentes (1992); Cifuentes *et al*. (1999); Aranguren *et al*. (2008); Segrado *et al*. (2008) and Zacarias *et al*. (2011) these result should not be accepted easily, as interpretation could assume several forms or patterns, depending on the conditions and circumstances in the tourist areas is the condition of the natural resources, regional policy, management method and characteristics of tourists. But McCool & Lime (2001) different views based on their arguments on subjectivity when identifying their respective indicators and there are difficulty building relationships between the number of visitors and their respective indicators. Therefore, carrying capacity of beaches cannot be defined only based on to the capacity of the beach area but can be conditioned by other factors or indicators such as parking facilities (Silva *et al*., 2007).

According to Nurazizah (2014), one way to resolve the limitation of the number of visitors by way of searching characteristics of tourists alike support environmental sustainability (green tourism). To support it, need to be made to the new pricing policy right based on value for money so that travellers get to experience on a trip that is expected to correspond to the value for money that you have paid.

Management of Tanjung Bira beach, in this case, is the local government has been a major factor in developing the object tourism. In fact, most of the managers of the inn, restaurant, and other facilities were private parties. Hence, required collaboration

between stakeholders (government, investors, and local communities) to manage tourist attraction.

Applying the concept of sustainable ecotourism becomes the main core of tourism development so that the next generation can enjoy this attraction. One of the steps that can be taken to create environment-based utilization zones such as the creation of ecotourism packages such as coral transplantation activities, mangrove planting and clean waste activities that can be used as education for tourists and infrastructure-based development for the entire Tanjung Bira beach area. Each zone is given space for development activities and placed in such a way that the main function of attraction is undisturbed and community activities are also undisturbed. One important aspect of the attraction is the socio-culture that can be used as object tourism. According to Chougule (2011), the socio-cultural approach defines input to attractions by local communities, visitors, and the government or non-government in maintaining the local culture in order to maintain preservation.

CONCLUSION

The value of Physical Carrying Capacity (PCC) of Tanjung Bira beach with extensive area of observations 23,050 m^2 obtained 2,257 beach users/day based on the results of the analysis of the total average area of the used space based on 7 common activities, the rotation factors, and the effective area that can be used by beach user. For the value of Real Carrying Capacity (RCC), the Tanjung Bira beach by considering some limitation factors (rainfall, the sunshine duration, abrasion, strong winds and temporary closure) obtained the value of carrying capacity is 202 beach user/day. The value of Carrying Capacity (ECC) by considering the conditions of Management Capacity (MC) of the tourist quality assessment results of the questionnaire obtained the value of carrying capacity 117 beach user/day.

The application of carrying capacity by limiting the number of tourists who can enter the coast is estimated to be between 117-202 beach users/day and is one way to preserve the ecosystem in the sea and surrounding areas. Limit accessibility to marine ecosystems such as snorkelling or diving areas (possible recovery time). This is useful to use the defined zoning concept ecologically, geographically, temporally, politically, or socially. Besides that, reducing the number of visitors is a difficult step for tourism managers to do is the local government. Other solutions for example by adding and improving existing facilities and expanding the coastal area by combining the coast of Tanjung Bira with Bara Beach.

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