Analysis of Tourism Carrying Capacity as a Basis for Development of the Tanjung Tampa Nature Tourism Park, Central Lombok Regency

Alvin Sofiandi Nursyam, Ketut Budastra, Lalu Sukardi

*Corresponding Author e-mail: sofiandialvin@yahoo.co.id

Received: August 2023; Revised: September 2023; Published: October 2023

Abstract

The development of the Tanjung Tampa TWA into a natural tourism destination that can support one of the priority national tourism destinations in the Mandalika Special Economic Zone (KEK) must pay attention to the carrying capacity of the Tanjung Tampa TWA so that it does not cause negative impacts that can damage the biophysics of the area. This research aims to analyze the tourism carrying capacity of Tanjung Tampa TWA using the Cifuentes method. The research results show that the physical carrying capacity is 4720 tourists per day, the real carrying capacity is 161 tourists per day, and the effective carrying capacity is 121 tourists per day. The development of the Tanjung Tampa TWA by considering the results of the tourism carrying capacity analysis can be done by increasing the quantity of human resources. Improvements can be made by empowering communities around the Tanjung Tampa TWA area and improving the quality of community human resources by establishing and assisting natural tourism interpreters.

Keywords: Carrying Capacity, Development, Nature Tourism, Nature Tourism Parks


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INTRODUCTION

Tourism in Indonesia has become the second leading sector as a contributor to the country's foreign exchange. State foreign exchange receipts from the tourism sector can be increased by developing tourism destinations, tourism marketing, tourism industry and tourism institutions (MenKumHAM, 2011). The Ministry of Tourism and Creative Economy (Kemenparekraf) in the 5 year period from 2020 to 2024 is targeting as many as 25 sustainable natural tourism destinations based on forest areas to support 10 priority national tourism destinations (Menparekraf, 2020).

The development of natural tourism destinations based on forest areas can be increased by developing tourism destinations, tourism marketing, tourism industry and tourism institutions (MenKumHAM, 2011). The Ministry of Tourism and Creative Economy (Kemenparekraf) in the 5 year period from 2020 to 2024 is targeting as many as 25 sustainable natural tourism destinations based on forest areas to support 10 priority national tourism destinations (Menparekraf, 2020).
The Ministry of Environment and Forestry has designated an area of 27.26 million hectares of conservation forest, both terrestrial and aquatic (Wiratno, 2018), which is spread over 560 units throughout Indonesia (DitjenKSDAE, 2021). One of the 560 conservation forest units that is attractive and can be developed into a natural tourist destination that can support one of the priority national tourism destinations in the Mandalika Special Economic Zone (KEK), namely the Tanjung Tampa Nature Tourism Park (TWA), because it is located in the core zone and buffer zone for the national tourism destination. Based on current conditions, Tanjung Tampa TWA has the potential to be a tourist attraction that can attract tourists in the form of diversity of fauna, diversity of flora, landscape and coastal landscape (Yoeti, 2003) and is supported by the existence of traditions and culture that live among the community and are still maintained to this day. Currently in the form of the madak tradition, namely catching fish at low tide which illustrates the values of brotherhood and friendship (Putra, 2022), apart from that there is also the bau nyale tradition, namely the tradition of catching sea worms (Nursaptini et al., 2020) which describes the values of patience and sacrifice for the benefit of society (Fazalani, 2018).

The development of Tanjung Tampa TWA into a natural tourism destination is in accordance with the master plan for regional tourism development in West Nusa Tenggara Province, namely the development of tourism destinations in the strategic tourism area of Kuta Mandalika and its surroundings (NTB, 2013). The development is also in accordance with the regional spatial plan for Central Lombok district, namely the development of tourism areas in the Kuta and Selong Blanak tourism areas as well as superior tourist attractions spread across Central Lombok district (Sekda Loteng, 2011) and in accordance with the regional tourism development master plan for Central Lombok district namely the development of natural tourism and marine tourism in the southern region (Sekda Loteng, 2016).

The West Nusa Tenggara Natural Resources Conservation Center (BKSDA NTB) as the person responsible for managing TWA Tampa which is the Technical Implementation Unit of the Ministry of Environment and Forestry (MenLHK, 2016), optimizes the use of environmental services and natural tourism according to the function of the area by paying attention to the carrying capacity of TWA Tanjung Tampa in receiving tourist visits so that they do not cause negative impacts that result in damage to the biophysics of the area itself (Walimbo et al., 2017). The carrying capacity of the environment or tourism is to determine the maximum limit of tourists that can be accommodated so that in the future the number of uncontrolled visits can be anticipated, because apart from being beneficial, tourist activities can also cause damage and decline in the quality of tourist destinations, the economy, socio-culture and the environment (Sari et al., 2015).

Environmental carrying capacity is the ability of an environment to support and balance the lives of living creatures, while carrying capacity is the ability of an environment to absorb all components that enter or are included in it (MenLH, 2009). The carrying capacity of the environment can be determined by knowing the environmental capacity and resources to support every human activity (MenLH, 2009). The environmental capacity for tourism activities is influenced by the presence of resources and environmental characteristics in the space used. The environmental carrying capacity for tourism activities is related to the number of tourists that can be accommodated by a tourist destination. So, in developing natural tourism in TWA Tanjung Tampa as a form of sustainable forest use, it must pay attention to the tourism carrying capacity and be based on the principles of sustainable development, namely ecological sustainability, socio-cultural sustainability and economic sustainability. The purpose of this research is to analyze the tourism carrying capacity of Tanjung Tampa TWA.

**METHOD**

The research was conducted at TWA Tanjung Tampa, Central Lombok Regency, West Nusa Tenggara Province. The research was carried out from January 2023 to September 2023. The scope of the research was to analyze tourism carrying capacity in the form of the number
of tourists allowed to visit TWA Tanjung Tampa. Tourism carrying capacity in this research is determined based on physical carrying capacity, real carrying capacity and effective carrying capacity so that it does not cause damage to the regional ecosystem.

This research is qualitative and quantitative research. The sampling technique used in this research was purposive sampling. The sample is tourists who come to visit and carry out tourist activities at TWA Tanjung Tampa. Determining the sample size in this study uses the Isaac and Michael formula (Sugiyono, 2013) with an error rate in this formula of 1%, 5% and 10%, whereas in this study an error rate of 10% is used, with a confidence level of 90%. The sample size in this study is in accordance with the following calculation results:

Information:
- \( s \) = sample size
- \( \lambda^2 \) = chi square at degree of freedom 1 with a 10% error rate of 2.706 (chi square table)
- \( N \) = population
- \( P \) = probability of correct (0.5)
- \( Q \) = probability of being wrong (0.5)
- \( d^2 \) = difference between the sample mean and the population. The difference in bias is 0.01, 0.05 and 0.1.

In this research, the \( N \) value or population was obtained at 1300, based on data on the number of tourists visiting TWA Tanjung Tampa in 2023, the error tolerance limit was 10% and the \( d \) value was 0.1. So with the equation (1) the sample size of tourists is 64 people.

Data sources are obtained from primary data and secondary data. Primary data was obtained by conducting observations, namely observing directly, seeing and taking the data needed at the place where the research was carried out, namely TWA Tanjung Tampa in the form of the area of the tourist destination, and the slope of the land (Sasmita et al., 2014) and interviews, namely collecting primary data. sourced directly from research respondents in the field, who provided information regarding the subject matter in the research in the form of tourist destination operational times and length of visit (Sofiyan et al., 2019). Secondary data was obtained through literature study in the form of area maps, number of officers, visitor data, flora diversity, fauna diversity and rainfall data.

The data obtained was then analyzed using the Cifuentes method (Cifuentes, 1992) which has been adapted to theories using the following equation:

Physical carrying capacity

\[ PCC = A \times \frac{V}{a} \times R_f \]  

Information:
- \( A \) = tourist area available or used
- \( V/a \) = area needed by a tourist to carry out tourism activities. According to (Herlambang et al., 2016) each tourist (V) needs an area of 65 m² to have a picnic (a).
- \( R_f \) = correction factor. In this research, the correction factor is obtained from the operational time of the tourist destination divided by the average time of tourist visits per day (Herlambang et al., 2016).

b. Real carrying capacity

\[ RCC = PCC - Cf_1 - Cf_2 - Cf_3 - Cf_4 \text{ or if converted in } \% \]  

\[ RCC = PCC \times \frac{(100-Cf_1)}{100} \times \frac{(100 - Cf_2)}{100} \times \frac{(100 - Cf_3)}{100} \times \frac{(100 - Cf_4)}{100} \]  

Information:
- \( RCC \) = Real carrying capacity
- \( PCC \) = Physical carrying capacity
- \( Cf_\) = Correction factor. In calculating the real carrying capacity which is the correction factor in this research, it refers to previous research conducted by (Sasmita et al., 2014) as follows:
  a. Flora diversity.
  The correction factor value for flora diversity can be obtained using the following Simpson Diversity Index equation:

\[ IDS= \frac{1}{\lambda} \text{ or } IDS= \frac{1}{(n(n-1))} \]
b. Faunal diversity
The correction factor value for flora diversity can be obtained using the following Simpson Diversity Index equation:
$$IDS= 1- \frac{\lambda}{\sum_{i=1}^{n}(n_i(n_i-1))/(n(n-1))}$$ ………………………………… (6)

c. Land slope
The land slope correction value can be obtained using the following equation:
$$Cf_{track} = \frac{M_l}{M_t} \times 100\%$$ …………………………………………… (7)
Specifications:
$M_l$ = Length of very steep track
$M_t$ = Overall track length
d. Rainfall.
The land slope correction value can be obtained using the following equation:
$$Cf_{track} = \frac{M_l}{M_t} \times 100\%$$ …………………………………………… (8)
Specifications:
$M_l$ = number of rainy days
$M_t$ = number of visiting days
c. Effective carrying capacity
$$ECC = RCC \times MC$$ …………………………………………… (9)
Information
ECC = Effective carrying capacity
RCC = Real carrying capacity
MC = Management capacity correction factor

The tourism carrying capacity at TWA Tanjung Tampa was obtained by comparing the values of physical carrying capacity, real carrying capacity and effective carrying capacity. If the comparison results show $PCC > RCC \geq ECC$, it means that the number of tourists can still be increased. Meanwhile, if the comparison results show $PCC < RCC \leq ECC$, it means that the number of tourists has exceeded the maximum carrying capacity limit.

RESULTS AND DISCUSSION
Based on the results of observations and interviews with managers, currently tourism activities at TWA Tanjung Tampa are focused on an area of 10.58 hectares in the Telawas Beach forest group which is a public space as depicted in Figure 1, so that the assessment of tourism carrying capacity is carried out in the area the.

![Figure 1. Map of current tourist activity locations at TWA Tanjung Tampa](image-url)
The determining factors in determining tourism carrying capacity can be obtained by carrying out calculations according to the following equation:

**Physical Carrying Capacity**

Physical carrying capacity is the maximum number of tourists that can be accommodated in the area provided at a certain time. Physical bearing capacity can be obtained by carrying out calculations according to equation (2). Based on the equation formula, observation results and literature study, the physical carrying capacity in the public space of the Telawas Beach TWA Tanjung Tampa forest group can be calculated as follows:

a. It is known that the area currently used for tourism activities is in accordance with the existing conditions at the research location, namely 10.58 hectares (A).

b. It is known that the value of V which is a tourist is 1.

c. The value of a is the area needed by tourists to carry out tourist activities, assuming that every tourist who visits TWA Tanjung Tampa has the aim of having a picnic, so picnicking requires an area of 65 m² (Herlambang et al., 2016).

d. The RF value is a correction factor obtained from comparing the daily operational time of tourist destinations with the average duration of tourist visits per day (Herlambang et al., 2016). It is known that TWA Tanjung Tampa's operational hours are from 07.30 to 16.00 WIT, which means 8.5 hours. According to the manager, the busiest visiting times are generally from 11.00 WIT to 14.00 WIT. Based on the results of interviews with respondents, it was found that the average time for tourist visits at TWA Tanjung Tampa was 2.9 hours as in Table 1 below.

<table>
<thead>
<tr>
<th>Length of Visit (hours) Category</th>
<th>Length of Visit (hours) Category</th>
<th>Length of Visit (hours) Category</th>
<th>Length of Visit (hours) Category</th>
<th>Length of Visit (hours) Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>1-5</td>
<td>26</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>3-4</td>
<td>3-5</td>
<td>30</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>5-6</td>
<td>5-5</td>
<td>8</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Jumlah</td>
<td>64</td>
<td>188</td>
<td>2.9</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 Average time of tourist visits at TWA Tanjung Tampa

Based on operational time and average visit time, a rotation factor value (Rf) = 8.5: 2.9 = 2.9 hours is obtained. From these known values, calculations are then carried out according to equation (2), so that the physical carrying capacity of Tanjung Tampa TWA is 4720. These results show that the number of tourists that can be accommodated in the area which is currently widely used for tourist activities is 4720 tourists.

**Real Carrying Capacity**

Real carrying capacity is related to the maximum number of tourists permitted to visit a tourist area by considering correction factors according to the characteristics of the area. This value is obtained based on calculations using the equation formula (3). In this research the correction factor (Cf) used is as follows:

**Flora diversity (Cf1).**

Flora diversity is one of the correction factors in determining the real carrying capacity of the Tanjung Tampa TWA for the development of natural tourism because the tourism activities carried out will greatly influence the existence of plants in the area. The correction factor value for flora diversity is calculated using equation (6). Based on the results of observations and literature studies, areas that are often used by tourists for tourism activities and calculating the flora diversity value using the Simpson Diversity Index equation, the flora diversity index value is presented in Table 2 below.
Table 2. Flora diversity index

<table>
<thead>
<tr>
<th>No</th>
<th>Type</th>
<th>Ni</th>
<th>ni(ni-1)</th>
<th>N</th>
<th>N(n-1)</th>
<th>λ</th>
<th>IDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beringin</td>
<td>15</td>
<td>210</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>2</td>
<td>Kesambi</td>
<td>11</td>
<td>110</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Ketapang</td>
<td>5</td>
<td>20</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Sengon</td>
<td>17</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Walikukun</td>
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<td>105300</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Waru</td>
<td>37</td>
<td>1332</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Amount</td>
<td>568</td>
<td>137422</td>
<td>568</td>
<td>322056</td>
<td>0.4267</td>
<td>0.5733</td>
</tr>
</tbody>
</table>

Based on Table 2, the correction factor value for flora diversity in tourist areas frequently visited by tourists is 0.5733 which is then converted into a percentage multiplied by 100% to 57.33%.

**Faunal diversity (Cf2)**

Faunal diversity is also a correction factor in determining the real carrying capacity in this research, because it will be greatly influenced by tourism activities. Calculation of fauna diversity correction factors using equation (7). The fauna diversity index values are presented in Table 3.

Table 3. Fauna diversity index

<table>
<thead>
<tr>
<th>No</th>
<th>Type</th>
<th>Ni</th>
<th>ni(ni-1)</th>
<th>N</th>
<th>N(n-1)</th>
<th>λ</th>
<th>IDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Kutilang</td>
<td>7</td>
<td>42</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Raja udang</td>
<td>15</td>
<td>210</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Kecial</td>
<td>36</td>
<td>1260</td>
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<td></td>
<td>Lombok</td>
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</tr>
<tr>
<td>4</td>
<td>Elang</td>
<td>3</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Gemak loreng</td>
<td>19</td>
<td>342</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Srigunting</td>
<td>5</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Koakiau</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Kera abu-abu</td>
<td>22</td>
<td>462</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Amount</td>
<td>109</td>
<td>2344</td>
<td>109</td>
<td>11772</td>
<td>0.1991</td>
<td>0.8009</td>
</tr>
</tbody>
</table>

Based on Table 3, the correction factor value for plant diversity in tourist areas frequently visited by tourists is 0.8009 which is then converted into a percentage multiplied by 100% to 80.09%.

**Slope (Cf3)**

The third correction factor is the level of slope on the tracking path or the path that tourists always pass to enjoy and get to the tourist attractions at TWA Tanjung Tampa. Based on the results of taking coordinates using GPS which was then processed using Arc Gis 10.4 software, the length of the tracking route used by tourists to enjoy the natural beauty at TWA Tanjung Tampa was 738 m. Based on the results of the slope data analysis according to the slope class which refers to the Decree of the Minister of Agriculture No.837/KPTS/UM/11/1980 (Hotasina & Darmawan, 2021) where 368 m is included in the steep route because it is on the back of the Telawas hill and has not been landscaped, while 370 m is included in the ramp because it is in the beach area and camping ground. The results of the slope data analysis of the tracking path are presented in Figure 2.
Figure 2. Slope conditions of the tracking route at the Tanjung Tampa TWA

From the results of the data processing, the correction value for the very steep track slope was then calculated using the formula equation (7) to obtain a correction value for the track slope of 49.86%. Meanwhile, based on the results of the Arc Gis 10.4 analysis as in Figure 2, it was also found that the area where tourism activities are not permitted because the area is very steep and cannot be passed because it endangers the safety of tourists is 17% or 1.8 ha of the area of 10.58 Ha. From this data, the correction value for very steep land slopes can be calculated using the following equation formula:

\[ C_{flahan} = \frac{M_l}{M_t} \times 100\% \]

\[ C_{flahan} = \frac{1.8}{10.58} \times 100\% \]

\[ C_{flahan} = 17.01\% \]

Based on the calculation of the correction value for very steep land slopes, a value of 17.01% was obtained. Then from the two correction values obtained, namely 49.86% and 17.01%, the correction value for the land slope in the Tanjung Tampa TWA can be determined by using the following equation:

\[ C_f = \frac{(C_{ft} + C_{flahan})}{2} \]

\[ C_f = \frac{(49.86\% + 17.01\%)}{2} \]

\[ C_f = 33.44\% \]

So the value of the land slope correction factor (Cf3) in the Tanjung Tampa TWA is 33.44%.

Rainfall (Cf4)

Rainfall is one of the correction factors in determining the real carrying capacity at TWA Tanjung Tampa because it can affect tourist comfort and limit the space for tourist activities. The value of the rainfall correction factor can be determined by comparing the number of rainy days with the number of visiting days (Sasmita et al., 2014). The data used in this research is rainfall data in Pujut District, Central Lombok Regency in 2020 and the day of visit at TWA Tanjung Tampa.

Based on data obtained, the total number of rainy days in Pujut District, Central Lombok Regency in 2020 was 145 days (BKSDA NTB, 2022) and the number of visiting days in 2023 based on the results of interviews with Tanjung Tampa TWA officers was 365 days. In accordance with these data, the value of the correction factor for rainfall can be calculated using equation (8). Based on calculations, the rainfall correction factor value at TWA Tanjung Tampa is 39.73%.

Based on the results of calculating the four correction factors, the correction values were obtained, namely fauna diversity with 80.09%, flora diversity with 57.33%, rainfall with...
and land slope with 33.44%. So what has the highest correction value is fauna diversity. Based on the results of calculations using equation (3), the real carrying capacity value at TWA Tanjung Tampa is 161. This result shows that the number of tourists that can be accommodated at TWA Tanjung Tampa based on existing tourist activities is 161 people every day.

**Effective Carrying Capacity**

Effective carrying capacity is related to the number of tourists who are allowed to visit TWA Tanjung Tampa based on the number of managers so that it can provide comfort to tourists who visit. Based on the results of an interview with the Head of the Tanjung Tampa TWA Resort regarding the number of NTB BKSDA officers who were given responsibility for managing the Tanjung Tampa TWA, there were four officers consisting of one Forestry Police, one Forest Ecosystem Controller and two Non-Employee Government Officers. Country. With the number of officers available and the guard schedule in the Telawas Beach TWA Tanjung Tampa forest group that has been prepared, the effective carrying capacity value can be obtained using equation (9).

The management capacity correction factor value based on the interview results obtained a result of 75% which was calculated using the following equation (Hotasina & Darmawan, 2021):

\[
MC = \frac{((\text{Number of daily officers})/(\text{number of officers}))}{\text{Number of officers}} \times 100 \%
\]

\[
MC = \frac{(2+2+2+2+2+2+2)/4}{4} \times 100\%
\]

\[
MC = 75\%
\]

Then the ECC value is as follows:

\[
ECC = RCC \times MC
\]

\[
ECC = 161 \times 75\%
\]

\[
ECC = 120.75
\]

Based on the calculation results, a value of 120.75 was obtained and rounded to 121. This result shows that the number of tourists that can be accommodated at TWA Tanjung Tampa is in accordance with the effective carrying capacity of 121 people every day.

Based on the calculation results, the physical carrying capacity related to the number of tourists that can be accommodated based on the current tourist activity area at TWA Tanjung Tampa is 4720 tourists per day. Meanwhile, with correction factors for flora diversity, fauna diversity, slope and rainfall, a real carrying capacity of 161 tourists per day is obtained and in accordance with management capacity correction factors, the effective carrying capacity is 121 tourists per day. So the tourism carrying capacity at TWA Tanjung Tampa is based on existing conditions, namely 121 tourists per day and can be increased to 161 people per day by increasing the number of management staff. Based on current conditions, tourism activities at TWA Tanjung Tampa can still be developed because the number of tourist visits per day based on interviews with managers and visit data averages 10 to 50 tourists. This number does not exceed the area's real carrying capacity of 161 people. So that the development of the Tanjung Tampa TWA by taking into account the results of the tourism carrying capacity analysis, based on current conditions, can be done by increasing the quantity of human resources. Improvements can be made by empowering the community around the Tanjung Tampa TWA area, improving the quality of community human resources by establishing and assisting natural tourism interpreters.

**CONCLUSION**

Based on the results of calculating the tourism carrying capacity at TWA Tanjung Tampa, the results obtained are the physical carrying capacity related to the number of tourists that can be accommodated based on the current tourist activity area at TWA Tanjung Tampa of 4720 tourists per day, the real carrying capacity is 161 tourists per day and an effective carrying capacity of 121 tourists per day. So the tourism carrying capacity at TWA Tanjung Tampa is based on existing conditions, namely 121 tourists per day and can be increased to 161 people
per day by increasing the number of management staff. Meanwhile, based on the results of interviews with managers and visit data, the average number of tourist visits per day is 10 to 50 tourists.

The development of the Tanjung Tampa TWA by taking into account the results of the tourism carrying capacity analysis, based on current conditions, can be done by increasing the quantity of managing human resources. Improvements can be made by empowering the community around the Tanjung Tampa TWA area where managers can first improve the quality of community human resources by establishing and assisting natural tourism interpreters.

RECOMMENDATION
The development of Tanjung Tampa TWA into a natural tourist destination that can support the existence of the Mandalika special economic area can be carried out by formulating a development strategy that takes into account the potential for tourist attractions, economic value, internal factors and external factors. So further research is needed regarding the tourist attraction and economic value of Tanjung Tampa TWA.

REFERENCES


