

# Practical Application of the Tourism Carrying Capacity Concept in Cultural Tourism: Example of the Maritime Museum of Montenegro

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## Abstract

*Until 2019, the picturesque nature, interesting geographical position and rich cultural heritage of Kotor kept attracting many visitors, resulting in an increasing number of visits to the Old Town and Maritime Museum of Montenegro, situated in Kotor. Currently (2020), the global pandemic brought everything to a halt, but once tourism starts recovering again the issue of sustainable management of tourism flows and use of cultural resources in Kotor will inevitably arise again. Since the Maritime Museum is included among the most popular visiting points in Kotor, this research aims to assess its real carrying capacity in order to compare the results to the official visitor statistics and determine whether the Museum, once the noble captain family Grgurina's home, with its valuable collections is exposed to high tourism pressure. The results indicated that the Maritime Museum, together with its valuable collections, was not subject to overconsumption or "overtourism", since the total number of realized visits in general, and visits by tourists organized in guided groups during 2019 was below the Museum's real carrying capacity. This paper builds on existing knowledge about the tourism carrying capacity in cultural tourism in Montenegro, suggests and elaborates concrete and replicable calculation methods, and offers useful data for sustainable management and strategic planning of visitor flows in cultural institutions situated at heritage sites.*

**Keywords:** cultural heritage, real carrying capacity, sustainable management

## Introduction

The rapid development of cultural tourism, followed by increased numbers of visits to the cultural sites, old towns, fortresses and other attractions, may significantly affect cultural and natural resources. Since resources are often limited in nature, finding the balance between their capacities and the level of their consumption by tourism has become one of the most important tasks in preventing disturbances and encouraging a steady and optimal utilization of all

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resources. The relationship between tourism and environmental sustainability is not unidirectional meaning that establishing sustainability influences the expansion of touristic activity (Pulido-Fernandez et al., 2019). Therefore, strategic monitoring of the development of cultural tourism and management of visitor flows needs to remain in line with the postulates of sustainable development, taking into account the results of the assessment of the tourism carrying capacities of old towns, cultural institutions, attractions or other relevant sites (Ensenat-Soberanis et al., 2018). During the previous decade, the number of individual tourists, cruise ship guests and organized groups accompanied by licensed tourist guides visiting Kotor Old Town was constantly growing, therefore, the purpose of this paper is an assessment of the tourism carrying capacity of one of the most popular visiting points of the Old Town, the public cultural institution, the Maritime Museum of Montenegro in Kotor, to fulfil the following research goals: 1) determining the real carrying capacity of the Museum; 2) comparing the officially published number of realized visits during 2019 with the Museum's real carrying capacity, and 3) assessing whether the cultural heritage is exposed to overconsumption. The hypothesis of this paper is that this Museum and its collections are not exposed to high tourism pressure, but at this stage, it is necessary to start defining and putting into practice measures that will keep ensuring further balanced and rational use of its cultural resources. In general, the presented calculation methods, data and drawn conclusions can be useful for destination managers, policy makers, marketers and other tourism stakeholders managing visitor flows and creating strategies linked to sustainable use, valorization, enhancement and protection of cultural heritage from overconsumption.

## Literature Review

The term "carrying capacity" (Verhulst, 1828) was first brought up by the Belgian statistician Verhulst who was interested in population growth and defined that new term as the maximum number of people who could use a recreational environment without unacceptable decline in the quality of the recreational experience. In time, this new term has started attracting more and more attention and several members of the academic society started giving their contribution to its definition. As a result, it was defined as the level of use of an area offering a high level of satisfaction with a small impact on resources (Aminian, Khodayar, 2016), as the maximum number of visitors that could physically fit into a defined space over a particular time (Lagarense, 2011) and as the maximum number of visitors who could physically be present at a given place at a certain time (Attallah, 2015). WTO defined this term as the maximum number of people that could visit a tourist destination at the same time, without causing destruction of the physical, economic or socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction (Overtourism, 2020). Due to offering practical data and being more a type of logical thinking than a metric issue (Cole, Carlson, 2010) nowadays, it is applied in a wide range of disciplines, including biology, ecology, anthropology, geography, tourism and business management (Vinals et al., 2014), which illustrates how much this concept is generally accepted (Joshi, Dahal, 2019).

Since tourist destinations can become fragile environments (Pratiwi, 2018), raising levels of tourism activity started increasing the level of interest in the sustainable development of tourism and drew more attention to the application of the concept of carrying capacity in tourism. An increase in cultural tourism also revealed the vulnerability of heritage resources during the phase of tourism exploitation, which resulted in the need to set limits and establish visitor management

tools to ensure the conservation of heritage resources and visitors' satisfaction (Vinals et al., 2014). To apply this concept in tourism, calculation methods have been modified in terms of taking into consideration the tourist flows, the size of an area, the optimal space available for each tourist to move freely, and visiting times (Attallah, 2015). The tourism carrying capacity assessment became essential in order to regulate and manage visitors (ArSalan et al., 2018), since only if tourism is undertaken responsibly, it can become a driver of preservation and conservation of cultural and natural heritage and a vehicle of sustainable development (Agnew, Demas, 2013).

Carrying capacity can be measured either at the level of a tourist destination as a whole, with all its associated contents, or at the level of individual, specific services or facilities (Pasko, 2016). Each type of capacity may significantly vary from one destination to another, depending on the natural and ecological characteristics of a given area, the manner of its use and developmental goals to be achieved (Schuh et al, 2020). Each capacity type is characterized by the tolerance limit of a destination as a whole or of individual buildings and facilities (Jovic, Dragin, 2008). According to several authors (Mathieson, Wall, 1982; O'Reilly, 1986; Lagarense, 2011; Lagomoj et al., 2013; Zelenka, Kaceti, 2014; Attallah, 2015; Wang et al., 2020), the basic two dimensions of carrying capacity that need to be taken into consideration in managing tourism flows are: a) the physical carrying capacity, and b) the real carrying capacity. They describe the physical carrying capacity as the maximum number of people who can use a site without an unacceptable alteration in the physical environment and without an unacceptable decline in experience quality. They explain the real carrying capacity as the maximum permissible number of visits of a given site, which is calculated by taking into account the limiting factors (translated into quantitative values) resulting from specific conditions of a given place. In general, the tourism carrying capacity has been developed largely as a response to the recognition that tourism could not progress fast without causing permanent damage, and therefore tourism flows needed to be continuously monitored in order for the destination management to be able to ensure the rational use of cultural and natural resources, and further sustainable development of the destination (Salerno et al., 2013). Monitoring tourist flows and designing strategies linked to tourist's spatial-temporal distribution can help anticipate and manage levels of tourism intensity, especially during peak periods (Han et al., 2020). The ability to anticipate, predict and project future events is very important and can be achieved through close monitoring of responses of foreign demand and harmonization of these responses with the carrying capacity of the destination, in particular its resources, which is the key to the successful and sustainable valorization of the tourist attractions (Magas et al., 2018).

## Tourism in Kotor during 2019

Along the Montenegrin coast, the region that belongs to the Municipality Kotor is one of the most attractive areas for the development of cultural tourism. It is rich in the significant cultural heritage of extraordinary historical, aesthetical and cultural value, well recognized by the UNESCO, the Government of Montenegro and Kotor Municipality. The highest concentration of cultural heritage of significant value is situated in the oldest urban area of this Municipality, Kotor Old Town, inscribed on the UNESCO's World Heritage List since 1979 for its outstanding natural and cultural values (Spatial Urban Plan of Kotor Municipality, 2019). Due to its unique attractions, rich material and immaterial traces of culture and well-preserved medieval atmosphere, until 2019, Kotor had kept on attracting a significant number of tourists who stayed overnight, but also visitors who stayed only for a couple of hours. In 2019, 532.419

visitors (10% more than in 2018) visited Kotor Old Town (Information on the Qualitative and Quantitative Results of the Tourism Season 2019): 366 cruise ships; 1,504 yachts; 169,511 individuals visited the Old Town walls, and 44,509 of them visited the Maritime Museum of Montenegro, situated within the Old Town. If the total number of visitors (532,419) is divided by 365 days of the year, it can be concluded that Kotor, on average, had 1,459 visitors per day, that is 2,488 visitors per day, if the same number is divided by 214 days (April-October), which is quite a significant number considering that the estimated number of inhabitants who live within the Old Town is 961, out of 22,601 inhabitants living in the territory of Kotor Municipality (Census of Population, Households and Dwellings in Montenegro, 2011).

This year, in 2020, Kotor shares the faith of most destinations in the world due to the Covid-19 pandemic which caused the emergence of drastic changes in everyday life, economy and tourism activity. Since this unpredictable new situation brought everything to a stall, 2020 offers time to recapitulate what was previously going on in cultural tourism in general, and to make plans what needed to be improved once the travel industry started recovering again. Once tourism is reactivated again, the natural question to ask ourselves is what we can expect if the number of visits starts increasing in Kotor again? How much tourism pressure cultural heritage can be exposed to before it starts breaking? Comparing to other old towns, the entire area of Kotor Old Town is relatively small, confined and highly accessible to visitors, and a carefully planned management of tourism flows, therefore, plays a crucial part in further safeguarding of the Old Town as a home, as a cultural heritage of significant value, and as a tourism destination.

## Research Methodology

Based on secondary data, the literature review, officially published documents and data of public bodies and statistical offices, and primary data obtained via direct field spatial analysis (area measurements and measurements of the guided route length) and field observations and analysis of different elements of cultural tourism activity in Kotor (timings of organized guided tours, characteristics, specifics and dynamics), gathered data has been processed using equations and methods for calculating carrying capacities in tourism. The used equations and methods were designed by several experts in this field (Ceballos-Lascurian, 1996; Lagarensen, 2011; Aminian, Khodayar, 2016), which are applicable in obtaining outputs that can be of use for directing further development of cultural tourism, and management of tourism activity at heritage sites. Presented models in this paper are applicable for other cultural sites or cultural institutions just by using relevant data and adjusting corrective or limiting factors (Cf) linked to the particular site, attraction or institution that is being analyzed. Due to its popularity among visitors, the public cultural institution, the Maritime Museum in Kotor, has been selected as the subject matter of assessment of the tourism carrying capacity. The physical carrying capacity has been calculated first, followed by the real carrying capacity calculation to determine the maximum permissible number of visitors in general, and the maximum permissible number of tourists visiting the Museum in organized guided groups. Then, the gathered data were compared to the results of the official visitor statistics in order to assess whether the cultural heritage is exposed to high tourism pressure. In order to achieve the above-mentioned goals, the following equations and calculation methods have been used:

First, the physical carrying capacity, or Pcc, was calculated in order to assess the maximum number of visitors who could be physically present at a given place at the same time (Attallah, 2015). In order to apply this method, it was important to determine the total usable area of the

Museum in square meters, and to determine the optimal space that needed to be available to each tourist or visitor to move freely and comfortably. In order to do that, the following equation (Lagarense, 2011; Jangra, Kaushik, 2017) was used:

$$Pcc = A \cdot U / a \cdot Rf \quad (1)$$

Where,

A=available area for use (m<sup>2</sup>);

U/a=area per user (m<sup>2</sup>);

Rf=rotation factor (working hours/duration of visit).

“A” is a determinant defined by particular conditions of the considered area; “U/a” is linked to the tourist density. It is the required area for tourists to undertake activities comfortably, or simply the area that each tourist needs to be able to easily move without having to interact with other people or physical objects. Considering the dimensions of an average adult, this normally covers a horizontal area of 1m<sup>2</sup>; The Rf represents the number of permissible visits over a specific period of time (Aminian, Khodayar, 2016).

To assess the maximum number of organized groups that can visit the Maritime Museum at the same time, maintaining a certain distance between the visiting groups, the following equation (Aminian, Khodayar, 2016) was used:

$$(X \cdot GS) + (X - OAP) \cdot D = A \quad (2)$$

Where,

GS=group size;

OAP=optimal area per person;

D=distance between groups;

A=total usable area of the museum.

The third step was to calculate the real carrying capacity of the Maritime Museum, which could be done only by taking into consideration the limiting factors or corrective factors (Cf) that affected tourist flows. The corrective factor is a factor, expressed as a percentage, which has a negative impact on tourism activities, assessed by a negative threshold and used for identifying the impact level of a factor (Aminian, Khodayar, 2016). These factors are selected based on tourism activities and the local conditions of the area that is being analyzed. Accordingly, in order to determine the maximum permissible number of visitors, taking into account the corrective factors, the following equation (Larganese, 2011; Melo et al, 2020) was used:

$$Rcc = Pcc \cdot ((100 - Cf_1) : 100) \cdot ((100 - Cf_2) : 100) \cdot \dots \cdot ((100 - Cf_n) : 100) \quad (3)$$

$$Cf = (Ml / Mt) \cdot 100 \quad (4)$$

Where,

Pcc=physical carrying capacity;

Cf=corrective factor;

Ml=limiting magnitude of variable;

Mt=total magnitude of variable.

## Result Analysis and Discussion

The Public Cultural Institution “Maritime Museum of Montenegro”, situated within Kotor Old Town, is quite a popular place to visit among many foreign visitors. According to the Information on Quantitative and Qualitative Results, last year (2019), the Museum recorded 44.509 visits: 6.729 individual tourists who used an audio guide; 30.600 tourists who visited the museum through travel agencies; 4.690 visitors in small groups; 2.490 children. In total, the Museum covers an overall area of 484m<sup>2</sup>, but the total usable area for visitor movement equals 384m<sup>2</sup>. To calculate the Pcc, the area of 1m<sup>2</sup> that an average tourist needed to feel comfortable to undertake activities was taken into account. First, the Pcc1 of the Museum was calculated, then the Rcc1 linked to the maximal permissible number of visits in general, then Pcc2 linked to the organized guided groups, and Rcc2 linked to the maximal permissible number of visitors who visited the Museum in organized groups escorted by licensed tour guides. While calculating Pcc2 and Rcc2, the distance of 3m between the groups was taken into account. Therefore, to do the calculations, the following parameters were included:

- Usable area: 384m<sup>2</sup> (A)
- Optimal area per person: 1m<sup>2</sup>; (U/a)
- Working time: 8hours;
- Optimal duration of the visit: 1 hour;
- Group size, including the tour guide: 35+1=36; (GS)
- Optimal distance between groups: 3m; (D)
- Estimated length of the sightseeing route: 175m (L)

First, the maximal permissible number of visitors who could visit the Museum on a daily basis, ensuring sustainable use of cultural heritage, was calculated as follows:

$$A = 384\text{m}^2 \quad U/a = 1\text{m}^2 \quad Rf1 = 8/1 = 8$$

$$Pcc1 = 384 \cdot 1 \cdot 8 = 3.072 \text{ visitors/day}$$

Accordingly, the maximum number of physically possible visits per day is 3.072. The result of Pcc1 is high due to the fact that it does not take into account many factors that also influence the number of visitors, therefore the real carrying capacity (Rcc1) of the Maritime Museum needed to be calculated as well, taking into consideration all corrective factors presented in Table 1.

**Table 1.** *Corrective Factors – 2019 Tourism Season in Kotor:*

Factor	Unit of Measurement	MI	Mt	Cf (%)
Cf1 Duration of tourist season	Month	7	12	58.33
Cf2 Number of working hours	Hour	1850	8760	21.12
Cf3 Period during the tourism season with an UV index of 8-10	Day	92	365	25.21
Cf4 Months during the season with high rainfall amounts	Month	2	12	16.66
Cf5 Months of slow traffic and traffic jams	Month	4	12	33.33
Cf6 Traffic blocked due to sports or other events	Hour	20	8760	0.23

*Source: Author's calculations*

$$Rcc1 = 3.072 \cdot ((100-58.33):100) \cdot ((100-21.12):100) \cdot ((100-25.21):100) \cdot ((100-16.66):100) \cdot ((100-33.33):100) \cdot ((100-0.23):100)$$

$$Rcc1 = 3.072 \cdot 0.42 \cdot 0.79 \cdot 0.75 \cdot 0.83 \cdot 0.66 \cdot 0.99 = 415 \text{ visitors/day}$$

Rcc1 = 12.450 visitors/month;  
88.810 visitors/tourism season (April-October);  
151.475 visitors/year;

The next step was calculating the maximum permissible number of visitors who could visit the Museum organized in guided groups per day. In order to achieve that, the first thing that needed to be assessed was the optimal number of organized groups that could be present inside the Museum at the same time, exploring the Museum collection with a tour guide and giving each other enough privacy, space and time to enjoy a high-quality experience. A minimum of 3m distance between groups was chosen to ensure enough space for individual visitors to be able to move between groups, and to avoid mixing of voices of tour guides and production of excessive noise.

$$GS = 36 \text{ U/a} = 1m^2 \text{ D} = 3m \text{ L} = 175m$$

$$(X-36) + (X-1) \cdot 3 = 175 \quad X = 5 \text{ or } Rf2 = 5$$

The equation result is  $x=5$ , meaning that 5 groups ( $GS=36$ ) can visit the Museum at the same time. Now, bearing in mind that  $Rf2=5$  and the group size ( $GS=36$ ), the maximum number of physically possible visits is:

$$Pcc2 = 384 \cdot 1.5 = 1.920 \text{ visitors in guided groups/day}$$

Accordingly, the maximum number of physically possible visits by tourists organized in guided groups per day is 1.920. It simply means that in one working day lasting for 8 hours this Museum can physically accommodate 53 groups, each consisting of 36 visitors. Although it is physically possible in theory, in real practice such a thing is highly unlikely to be achieved. The result of  $Pcc2$  is high due to the fact that it does not take into account many factors that also influence the number of visitors. Therefore, the real carrying capacity ( $Rcc2$ ), linked to visitors organized in guided groups, needed to be calculated taking into consideration all corrective factors illustrated in Table 1:

$$Rcc2 = 1.920 \cdot ((100-58.33):100) \cdot ((100-21.12):100) \cdot ((100-25.21):100) \cdot ((100-16.66):100) \cdot ((100-33.33):100) \cdot ((100-0.23):100)$$

$$Rcc2 = 1.920 \cdot 0.42 \cdot 0.79 \cdot 0.75 \cdot 0.83 \cdot 0.66 \cdot 0.99 = 310 \text{ visitors in guided groups/day};$$

Rcc2 = 9.300 visitors/month;  
66.340 visitors/tourism season (April-October);  
113.150 visitors/year;



In general, the maximum permissible number of visitors of the Maritime Museum is 415 visitors/day, and the maximum permissible number of visitors in guided groups is 310 visitors/day, in order to ensure further safeguarding and sustainable use of cultural heritage. Results show that the maximum permissible number of groups ( $GS=36$ ) inside the Museum at the same time is 5. Comparing the number of realized visits (RS) to the Museum during 2019, which was 44.509, to the real carrying capacity ( $Rcc1$ ), which is 88.810 visitors per tourism season (7 Months: April-October) and 151.475 visitors per year, it can be concluded that the number of realized visits did not exceed the permissible numbers of visits ( $RS < Rcc1$ ) for both time periods during 2019. In fact, the total number of realized visits represents 50% of the seasonal and 29% of the annual real carrying capacity ( $Rcc1$ ) of the Museum. Comparing the number of realized visits by tourists who visited the Maritime Museum in organized guided groups, which was 30.600, with the Museum's real carrying capacity linked to organized guided groups ( $Rcc2$ ), which was 66.340 visitors per tourism season and 113.150 visitors per year, it can be concluded that the number of realized visits did not exceed the permissible number of visits ( $RS < Rcc2$ ) for both time periods during 2019. Accordingly, the total number of realized visits represents 46% of the seasonal and 27% of the annual real carrying capacity ( $Rcc2$ ) of the Museum. Therefore, it can be concluded that the Maritime Museum, as a significant historical building built in baroque style, once the home of the captain family Grgurina (XVIIIc.), and its valuable museum collections are neither subject to tourism overconsumption nor exposed to a high tourism pressure. This confirms the hypothesis of this research.

## Conclusion

Aiming to investigate the impacts of tourism on the Maritime Museum of Kotor, this study focuses on assessing whether the number of visits exceeds the limits of acceptable impact on cultural heritage and offers calculation methods and data that can be useful for the staff of this or similar cultural institutions, as well as other relevant tourism stakeholders, in making further decisions regarding the management of visitor flows and the protection of cultural heritage. The results indicate that the number of visits does not exceed the real carrying capacity of the Maritime Museum, and therefore this cultural institution and its cultural resources are not subject to "overtourism" and "overconsumption", respectively. Using a concrete example, this research suggests and elaborates an applicable method of Tcc calculation. It explains one of the possible ways how to obtain concrete data and compare them to accessible official data offering relevant stakeholders a better insight into the current situation, as well as a starting point that can stimulate discussion, brainstorming and making evidence-based decisions regarding visitor flows (e.g. entry times, group sizes, required distances between groups, establishment of routes directing visitors, etc.) in order to ensure further rational use of cultural heritage. Further studies may focus on the public areas or squares within Kotor Old Town, other captains' mansions and sacral buildings within and outside the Old Town itself, taking into account additional corrective or limiting factors, characteristic of public spaces and sacral heritage to motivate the creation of special tourism strategies linked to safeguarding and sustainable use of cultural and sacral resources in Montenegro. Ultimately, this study serves to encourage further research linked to the assessment of the tourism carrying capacity in cultural tourism and to inspire relevant stakeholders to use suggested methods and equations while making evidence-based decisions regarding the sustainable management of visitor flows.



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