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Front cover photography: Large avalanches like the January 2021 »twin avalanche« in the upper Soča Valley that reach the valley floor will be unavoidable in the Alps in the future, as climate warming actually triggers them, contrary to expectations (photograph: Jure Tičar).
Fotografija na naslovnici: Velikim snežnim plazovom, kakršen je bil »dvojček« januarja 2021 v Zgornjem Posočju, ki dosežejo dolinsko dno, se v Alpah tudi v prihodnosti ne bomo izognili, saj jih otoplitev podnebja, nepričakovano, celo povzroča (fotografija Jure Tičar).

TOURISM CARRYING CAPACITY IN THE MUNICIPALITIES OF TOLMIN, KOBARID AND KOMEN

Igor Jurinčič



BLAŽ MOČNIK (© DELO)

Traffic at the confluence of Tolminka and Soča rivers in August 2019.

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Igor Jurinčič¹

Tourism carrying capacity in the municipalities of Tolmin, Kobarid and Komen

ABSTRACT: The study of tourism carrying capacity in the municipalities of Tolmin, Kobarid and Komen has shown that the infrastructural and economic carrying capacity is the most problematic, as most indicator limits are already exceeded in the summer season. The most favourable is the spatial-ecological carrying capacity, where none of the studied indicator limits were exceeded. The results of the carrying capacity assessment for tourism in these municipalities should not be used as a tool to restrict tourism development, but rather as expert recommendations to promote more sustainable tourism development. Infrastructure identified as deficient cannot be improved immediately. Improvements require large financial investments that municipalities are not able to ensure quickly. We need a tourism development strategy that, in addition to all the necessary improvements, comprehensively addresses the problems that municipalities face from overtourism, especially during the high season.

KEY WORDS: tourism carrying capacity, indicators, infrastructure, sustainable tourism, overtourism, Soča Valley, Karst Plateau

Turistična nosilna zmogljivost občin Tolmin, Kobarid in Komen

POVZETEK: Raziskali smo turistično nosilnost v občinah Tolmin, Kobarid in Komen. Ugotovili smo, da je najbolj problematična infrastrukturna in gospodarska nosilnost, saj je večina kazalnikov preseženih že v poletni sezoni. Najbolj ugodna je prostorsko-ekološka nosilnost, kjer ni bil presežen noben od proučevanih kazalnikov. Rezultatov ocene nosilne zmogljivosti za turizem v teh občinah ne bi smeli uporabljati kot orodje za strogo omejevanje turističnega razvoja, temveč kot strokovna priporočila za trajnostni razvoj turizma. Infrastrukturnih zmogljivosti ne moremo povečati na kratek rok, saj to zahteva velike finančne vložke, ki jih občine ne morejo zagotoviti tako hitro. Potrebujemo strategijo razvoja turizma, ki bi poleg vseh potrebnih izboljšav celovito obravnavala težave, s katerimi se soočajo občine zaradi prekomernega turizma, zlasti v visoki turistični sezoni.

KLJUČNE BESEDE: turistična nosilna zmogljivost, indikatorji, infrastruktura, trajnostni turizem, prekomerni turizem, Dolina Soče, Kras

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1 Introduction

The first studies undertaken on carrying capacity date back to the 1960s. The carrying capacity of an area means the maximum number of people, plants and animals in a given area that can live undisturbed naturally, and which can be sustained in such conditions without reducing the carrying capacity of the environment in the future (Butler 2020). The number of people who can coexist in a sustainable and long-term basis with the environment is therefore defined, without deteriorating the quality of the environment and all its other inhabitants with their presence.

Carrying capacity in tourism means the greatest number of visitors that a tourist destination can accommodate without creating irreversible negative effects on the environment or the local community, while tourist satisfaction remains unchanged (World Tourism Organization 1996).

When analysing the carrying capacity, we are faced with the question as to what extent a certain impact continues to be acceptable and how to properly plan for further development so that it remains sustainable and the carrying capacity of an area is not exceeded. If we do not take into account the carrying capacity of the environment, it means that we have exceeded the permissible capacity limits which, in nature, means a sustainable condition, where nature, despite all the pressures, can renew itself (Mavri 2018a).

The assessment of carrying capacity is a method used to determine the effects of tourism on the environment and relative spaces where we study and assess the impact of interventions in a given area. It is an important part of spatial planning in tourism and represents one of the most important tools in sustainable tourism (Jovičić and Dragin 2008; Jurinčič 2009). The method used in assessing carrying capacity, as we know it today, is more dynamic than in the past. The role of the method has changed, as the purpose is not to create limitations when defining the capacity limit at a single point, but rather a tool through which we can constantly monitor and assess the development in order to use the results as a basis for further management and planning (Coccosis, Mexa and Collovini 2002; Jurinčič 2005).

Regarding the type of carrying capacity, there are several different divisions which are otherwise quite similar. The World Tourism Organization divides the carrying capacity into three types, namely environmental, socio-cultural and psychological (Jovičić and Dragin 2008). Some authors cite a division where there are four types of carrying capacity, namely (World Tourism Organization 1998):

- the environmental carrying capacity which is based on physical and biological factors of selected species without any disturbances,
- the socio-cultural carrying capacity is determined by assessing any unacceptable impact felt by the local community or by restrictions related to the availability of human resources,
- the psychological carrying capacity refers to an acceptable limit of visitor numbers without a decrease in the quality and satisfaction of the experience which differs depending on the type of tourism and the type of activity,
- the infrastructure carrying capacity is determined by the size of the tourist destination's infrastructure, such as the number of rooms as well as municipal and road infrastructure capacity. This is the most stable in the long term as the infrastructure does not change at a fast rate.

Nature conservation areas in the USA were among the first tourist areas where the carrying capacity method was used to manage tourism (Manning 1999). They were followed by other nature conservation areas in Europe (Mandić and Marković Vukadin 2021) and also in Slovenia (Jurinčič and Balažič 2011; Mavri 2018a; 2018b; Jurinčič 2020). According to the method designed by Priority Actions Programme, Regional Activity Centre (1997) with its relative upgrades, carrying capacity analyses for beaches in the Mediterranean were undertaken for Croatia (Klarić et al. 2003; Grofelnik 2020), Slovenia (Jurinčič 2005, 2009), Greece (Tselentis, Prokopiou and Toanoglou 2006; Tselentis et al. 2006; Prokopiou, Tselentis and Bousbouras 2008), Portugal (Zacarias, Williams and Newton 2011), Spain (Baños Castiñeira and Viñals Blasco 2020), Italy (Corbau et al. 2019) and Montenegro (Klarić and Marković 2013).

In the UNESCO heritage destination of the Dolomites in Italy, where they are dealing with the negative effects of overtourism, they have found that the use of technology that enables the monitoring and measurement of overtourism a useful tool, where they could promote an alternative offer for tourists in the vicinity of a crowded main attraction (Bertocchi, Camatti and van der Borg 2021). The importance of mobile applications for directing and regulating sustainable visits to lesser-known tourist attractions was also highlighted by Jurinčič et al. (2013) and Cvetković et al. (2016). After analysing the carrying capacity, they found that the current situation allows a maximum of 4000 visitors to the historic city centre of

Dubrovnik at any one time (Camatti et al. 2020). In the Škocjan Caves Park, which is famous for its exceptional natural beauty, they found (Jurinčič 2020) that 300 visitors could be accommodated in the cave at any one time, or a total of 1800 visitors a day.

Total carrying capacity, according to the adapted United Nations Environment Programme (UNEP) methodology and given the particularities of the destination in question and the use of a smaller number of key carrying capacity indicators, has been reviewed several times in Slovenia at municipality level by Jurinčič and his colleagues. A study of the carrying capacity for the area of the Idrija municipality was undertaken to prepare a tourism marketing strategy there (Ravnikar et al. 2009), and for the Metlika municipality in order to plan the development of tourism along the Kolpa River (Jurinčič 2006) while the municipality of Bled was studied for research purposes (Golob 2011). An important advantage of such an integrated approach is that it offers a combination of environmental, social and economic aspects of the carrying capacity to provide a total carrying capacity for each municipality and region. Such cases are rarely found in relative literature. Another advantage of comprehensive carrying capacity analyses is that it also helps to determine carrying capacity thresholds, despite the fact that we consider and compare different indicators. Although these are subjective estimations of the value of each indicator on a scale of 1–9, they are based on verifiable quantitative data.

The aim of this paper is to answer the question as to whether the carrying capacity for tourism has already been exceeded in the areas of the municipalities of Kobarid, Tolmin and Komen as tourism has increased in these areas significantly over the last decade.

2 Methods

The municipalities of Tolmin and Kobarid in the Upper Soča Valley region and the municipality of Komen in the Karst region are rural municipalities of Slovenia located in the west of the country along the Italian border. The economy is based mainly on industry while tourism has grown extremely rapidly over the last ten years. The Upper Soča Valley and Karst are becoming one of the most important tourist destinations for active holidays in Slovenia. Most of the municipalities of Tolmin and Kobarid are a part of the Triglav National Park and are designated protected areas of Natura 2000. 98% of the Komen municipality is classified as being in the Natura 2000 area. Due to their many natural and cultural attractions, they are proving to be of interest for visitors who are looking for breaks in a clean and peaceful environment which is rich in cultural heritage and offers excellent culinary experiences. The success of tourism in the long term will only be ensured by maintaining good quality tourist-based amenities and other attractive offers.

Based on our experience in carrying capacity analysis for several other municipalities in Slovenia (Jurinčič 2005; Jurinčič 2006; Ravnikar et al. 2009; Golob 2011), we have selected and here discuss nine indicators in more detail for the municipalities of Tolmin, Kobarid and Komen. We assume these indicators play an important role and will consequently provide us with the best overall assessment of the carrying capacity of each municipality for tourism. We have classified them into three different groups of indicators.

Among the spatial-environmental indicators, we have selected:

- surface water quality of the Soča river basin in the Tolmin and Kobarid municipalities and Natura 2000 in the municipality of Komen,
- waste collection and treatment and
- the supply and consumption of potable water.

Among the infrastructure indicators, we selected:

- the number of parking spaces,
- the length of renovated local and national roads, and also cycle trails.

Among the economic indicators, we have selected:

- the number of nights stayed,
- the number of tourists, and
- the number of accommodation facilities.

The individual indicator was assessed by allocating a numerical value according to the predefined carrying capacity framework. As a criterion for easier display, we adopted values on a scale from 1 to 9, where values between 1.0–2.9 mean that the indicator shows a lower level of utilisation of development potential (unused), values from 3.0–5.9 mean that the indicator shows a higher level of utilisation of development potential and does not exceed the carrying capacity (not exceeded), and values between 6.0–9.0 mean that the carrying capacity estimate has been exceeded (exceeded).

The assessment of the carrying capacity for each indicator is based on real data, but we are aware that its numerical representation is somewhat subjective. The carrying capacity of surface water quality of the Soča and Nadiža rivers was assessed on the basis of continuous monitoring of bathing waters of the ARSO. Natura 2000 areas were assessed in terms of biodiversity conservation and the level of awareness of both tourists and the local population about its importance. The waste collection and treatment system was assessed according to the trend of the movement of collected and disposed waste and deemed to exceed the carrying capacity when the amount of disposed waste increases and the proportion of selectively collected waste does not increase. The supply of potable water exceeds the carrying capacity when the potable water becomes scarce and austerity measures are required. Parking spaces exceed the carrying capacity when basically there are not enough of them. The length of renovated local and national roads is exceeded when traffic safety is threatened and traffic flow is reduced leading to forms of congestion. Cycling trails exceed the carrying capacity when there are not enough of them and when they are not considered safe enough or properly indicated. Economic indicators, however, are exceeded when there is a shortage of beds and it is necessary to redirect guests to other destinations.

Table 1 shows the estimated numerical value of the indicators (1–9), the assessment of the carrying capacity of the indicators (unused, not exceeded and exceeded) and the proposals for increasing the carrying capacity of the destination (municipality). Data for the assessment of each indicator were taken from available databases for the period 2011–2020 (Environmental atlas of Slovenia, Spatial information systems of municipalities (PISO), municipal development plans, Slovenian Infrastructure Agency and Statistical Office of the Republic of Slovenia) and from the information obtained through personal communications with tourism managers in the municipalities in question, where they highlighted trends in tourism and problems which are generally similar in nature for all three municipalities. Below, we have justified a certain value of the carrying capacity for each indicator. In order to improve the exceeded carrying capacity in the future or to prevent exceeding the carrying capacity at indicators that have not yet been exceeded, we have developed proposals to increase the carrying capacity in question.

3 Assessment of the carrying capacity for tourism in the municipalities of Tolmin, Kobarid and Komen

In assessing the carrying capacity for tourism in the municipalities of Tolmin, Kobarid and Komen, we have selected and here discuss nine indicators for which we argue they play an important role and will therefore provide us with the best overall assessment of the carrying capacity of each municipality for tourism.

We assessed that the best indicator in the group of spatial-ecological indicators was the surface water quality of the Soča river basin. On the basis of favourable results derived from extensive analyses and continuous monitoring undertaken by the Institute for Waters of the Republic of Slovenia, we assessed its current status as 'unused' giving the municipality of Tolmin a value of 3. Based on the bathing water data provided by the Slovenian Environment Agency, it was found that the river Nadiža, in the Kobarid municipality, is the river most below the threshold of carrying capacity and we therefore gave this one a value of 2. The carrying capacity of the water quality is unused but we do not want to load this indicator any further. In order to maintain surface water quality adequately in the Soča and Nadiža river basins, it is necessary to continue to build appropriate wastewater discharge and treatment systems in Tolmin and Kobarid, to limit the use of the coastal zone, to regulate the discharge of all storm water as well as to prevent all illegal discharges and to take appropriate care of the river itself and the area along it with various actions to be undertaken by local residents. Due to the absence of surface water on the Karst, protected natural areas of Natura 2000 were selected in the Komen municipality. The preserved karst nature of the landscape is one of the main motives for visiting the entire Karst region. When examining the indicator for the protected natural area of Natura 2000 in Komen, we found that this indicator has not been exceeded. Numerous projects in the field of biodiversity experience, education, workshops and festivals have been undertaken, or are in the process of being undertaken, which shows that the attitude of local residents towards protecting the natural environment is positive (with the renovation of ponds, regulating paths, with a planned establishment of a Geopark with an information and education centre). The number of tourism providers included in Slovenian Tourism's Green Scheme, - Slovenia Green, is also on the increase.

Table 1: Assessment of carrying capacity indicators for the Tolmin, Kobarid and Komen municipalities.

Type and selected indicators	Estimated indicator value and CC rating	Proposals to increase the carrying capacity
Spatial-environmental		
Quality of surface waters in the Soča river basin/ Natura 2000	Tolmin 3 unused	Tolmin, Kobarid, Komen: construction of treatment plants; increase control of pollutants, activities in the area and water quality; prevention of illegal discharges; cleaning campaigns; raise visitor awareness of the vulnerability of the area. Komen: establishment of the Karst Geopark.
	Kobarid: 2 unused	
	Komen: 5 not exceeded	
Collection and treatment of waste	Tolmin: 5 not exceeded	Tolmin, Kobarid, Komen: follow waste management trends; adequately inform local residents and tourists about waste sorting (stickers, brochures and whiteboards – also in foreign languages); to provide more waste bins in those areas where there are a greater number of tourists and at mass events; to empty waste bins regularly. Tolmin, Kobarid: to increase controls on illegal camping.
	Kobarid: 5 not exceeded	
	Komen: 4 not exceeded	
Supply and consumption of potable water	Tolmin: 5 not exceeded	Tolmin, Kobarid, Komen: raise awareness and inform the local population and visitors about the vulnerability of water resources; encourage the collection of rainwater; use treated water from treatment plants for irrigation, cleaning roads etc.; promote green business and self-supply of potable water; control the consumption and quality of potable water.
	Kobarid: 5 not exceeded	
	Komen: 5 not exceeded	
Infrastructure		
Parking spaces	Tolmin: 9 exceeded	Tolmin, Kobarid, Komen: to provide information boards; construct additional parking lots; introduce parking fees or time-limited free parking; provide parking lots for larger vehicles; promote sustainable forms of transport and public transport; establish appropriate signage; provide stewards at planned events.
	Kobarid: 9 exceeded	
	Komen: 8 exceeded	

Length of renovated local and national roads	<p>Tolmin: 8 exceeded</p> <p>Kobarid: 7 exceeded</p> <p>Komen: 7 exceeded</p>	Tolmin, Kobarid, Komen: to renovate roads faster; put warning signs at dangerous sections and establish road sharing (including cyclists); increase traffic safety.
Cycling trails	<p>Tolmin: 9 exceeded</p> <p>Kobarid: 9 exceeded</p> <p>Komen: 7 exceeded</p>	Tolmin, Kobarid, Komen: expand cycling trails; provide adequate signalling; regulate infrastructure properly in respect of cycling trails (provide parking spaces for bicycles, bicycle services, bicycle-friendly accommodation and increase availability of public transport for bicycles); exploit the exceptional potential for cycling tourism.
Economy	<p>Tolmin: 6 exceeded</p> <p>Kobarid: 7 exceeded</p> <p>Komen: 8 exceeded</p>	Tolmin, Kobarid, Komen: increase the quality of existing capacities and consequently increase the prices and manage tourist visits; offer new services in order to deseasonalise tourist visits; extend the length of tourist stays outside the season; control the registration of guests and payments for using general infrastructure services. Tolmin, Kobarid: prevent illegal camping.
The number of tourists	<p>Tolmin: 6 exceeded</p> <p>Kobarid: 8 exceeded</p> <p>Komen: 6 exceeded</p>	Tolmin, Kobarid, Komen: expand existing general and tourist infrastructure; control the registration of guests and payments for using general infrastructure services; increase the quality of services and the consequent increase in prices; Establish admission fees for tourist attractions; Expand offers across the whole municipality.
The number of accommodation facilities	<p>Tolmin: 7 exceeded</p> <p>Kobarid: 6 exceeded</p> <p>Komen: 7 exceeded</p>	Tolmin, Kobarid, Komen: provide incentives for investors to invest in additional accommodation facilities (smaller hotels, dispersed hotels, glamping, tourist farms and eco accommodation); raise the quality and prices of services to match demand with available facilities.

When examining the indicator for waste collection and treatment, we found that the Tolmin municipality was exemplary in this area. The amount of waste increased by 45% in the period 2012–2019, although it decreased in 2020, but at the expense of fewer tourist visits due to the Covid-19 pandemic, so its carrying capacity was allocated a value of 5. Therefore, the amount of waste in 2019 was the highest it has been in the last ten years at 462 kg/inhabitant, according to the data on collected waste 2011–2020 provided by the Statistical Office of the Republic of Slovenia (Table 2). As the volume of waste also increases in relation to the increase in the number of tourists, raising awareness must be targeted, not only at the local population but also at tourists. We have found that the collection and treatment of waste in the municipality of Kobarid is exemplary. As the number of overnight stays made by tourists in Kobarid increases, the amount of collected waste will also rise. Waste management will also improve due to adequate information on the number of tourists at a certain destination, so the recording and reporting of this information must be regulated. According to the data obtained, the indicator for the collection and treatment of waste was assessed to have a value of 5 as the indicator has not been exceeded. Although the amount of waste has been increasing in recent years, the municipality is following trends in the field of waste collection and treatment, and is also raising awareness of trends and waste collection among the local population and tourists.

For the municipality of Komen, in the group relating to spatial-ecological indicators, the indicator for the collection and waste treatment was assessed as best, with a score of 4, so consequently it did not exceed its margin. We noticed that the increased number of nights and events did not affect this indicator which we would like to see continue in the future. In order to maintain this factor, we would like to see greater promotion of Komen as a green destination, with information material published in foreign languages etc.

The indicator for potable water supply and consumption in all three municipalities was assessed as a five, an indicator showing that it has not been exceeded. This is justified by the fact that there is enough water in these municipalities, and the supply provided by Tolmin's public services for Tolmin and Kobarid and the Karst water supply in Komen are also considered adequate. Water consumption in Tolmin, Kobarid and Komen is fairly stable, which is encouraging (Hvala 2018; Baša 2020; Volarič 2020). According to the data provided by Tolmin's public services for the years 2014–2019 for the municipality of Tolmin, the volume of water sold increased by 0.8%, and in Kobarid by 8.5%. According to the data provided by the Sežana Karst Water Board for the period 2008–2018 covering the municipality of Komen, the volume of water sold increased by 0.5%. As the number of overnight stays increases, the consumption of potable water will also increase, so we need to handle water supplies as carefully as possible in the future, as there are no natural water collection areas on the Karst, and groundwater sources are very vulnerable. It is necessary to act sustainably and to reduce water consumption per capita and per tourist overnight stays with appropriate measures. We propose to raise awareness among the local population and tourists about the impact of climate change on the supply of potable water and to fight against climate change. It is important to promote the use of recycled water and the collection of rainwater in order to avoid a shortage of potable water in the future.

Table 2: Municipal waste generated, collected and disposed of (kg per capita) in Tolmin, Kobarid and Komen from 2011 to 2020.

Year	Municipal waste generated (kg per capita)			Municipal waste collected by public collection (kg per capita)			Municipal Waste Disposed (kg per capita)		
	Tolmin	Kobarid	Komen	Tolmin	Kobarid	Komen	Tolmin	Kobarid	Komen
2011	–	–	–	315	346	227	210	224	116
2012	317	346	246	282	311	211	163	178	105
2013	368	399	404	274	305	310	84	16	132
2014	399	427	340	288	316	229	77	83	84
2015	430	454	359	295	318	224	181	263	76
2016	402	455	376	273	326	292	–	–	–
2017	442	498	367	303	359	227	0	–	11
2018	449	505	374	315	371	240	14	18	11
2019	462	537	382	311	386	231	66	0	3
2020	318	398	364	294	369	341	33	8	2

The parking space indicator was assessed to have been an exceeded indicator in all three municipalities. Most parking spaces in the Tolmin municipality are allocated for shops such as Hofer, Eurospin and Mercator. In 2018, 593 parking spaces were available in Tolmin (Hvala 2018). In addition to the larger towns in the municipality (Tolmin, Most na Soči and Podbrdo), there is a shortage of parking spaces at the most visited spots in the municipality (Tolmin Gorge and the Church of the Holy Spirit in Javorca). It was concluded that this problem needs to be addressed from a broad perspective as it is linked to the construction of the by-pass and is the result of weak infrastructure for cyclists and pedestrians. The indicator for parking spaces in Tolmin and Kobarid was assessed to have a value of 9 and therefore an exceeded indicator. There are not enough parking spaces in Kobarid during the tourist season. There were 268 recorded parking spaces provided in Kobarid in 2020 (Volarič 2020). According to the inter-municipal chief administrator, the greatest shortage of parking spaces were noted in Kobarid and at the more popular tourist destinations throughout the municipality (accessible points to the bathing areas along the Nadiža and the Soča rivers). Since 2016, Hop-On Hop-Off bus transport has been organised in the municipality of Kobarid, connecting the countryside, remote tourist points, bathing areas along the Nadiža and starting points for hiking and cycle routes to the heart of Kobarid. In the municipality of Tolmin there is a bus service to the Tolmin Gorge and to the Church of the Holy Spirit in Javorca, which has somewhat relieved road congestion and the pressure on parking spaces. Looking forwards, action will have to be taken to tackle this problem, as some visitors park in private parking spaces and privately owned land as well as along roadsides, where passage is already very limited (Figure 1). The indicator for parking spaces for the municipality of Komen was assessed to have a value of 8 and is therefore an exceeded indicator, as we believe that there are not enough parking spaces with respect to its needs.

We assessed the indicator for the length of renovated local and state roads to have a value 8. Due to the high construction costs associated with the complexity of the terrain, renovation works in the Tolmin



Figure 1: Crowded parking area at the entrance to the Tolmin Gorge in July 2019.

area are slow. Road infrastructure needs to be improved, and as much as possible should be done to improve the safety of all road users. The indicator for the length of renovated local and state roads for the municipality of Kobarid was deemed to have a value of 7, therefore the indicator has been exceeded. Road infrastructure in the Kobarid area is slowly improving, and it should continue to improve. In future, dangerous road sections should be properly regulated in order to increase safety. The indicator for the length of renovated local and state roads was also assessed to have a value of 7 for the municipality of Komen. Reconstruction works on local and state roads were mostly undertaken in the years before 2014, and not one local road has been renovated since then, regardless of the fact that there are many dangerous, narrow sections through certain villages, in Komen, Gorjansko, Štanjel, Ivanji Grad, Škrbina and Brje pri Komnu for example.

For the municipalities of Tolmin and Kobarid, the indicator for cycle trails was assessed to have a value of 9, and therefore it has exceeded indicator, because there are insufficient or hardly any designated cycle trails. In both municipalities, cyclists mainly use the existing road network. The cycle trail was allocated an indicator value of 7 for the municipality of Komen as there are no designated cycle trails in the municipality, and the accompanying infrastructure network is also insufficient. In addition to a better network of cycle trails, the system for automated bike rental »Bike Sharing on the Karst« within the framework of the Interreg project, CROSSMOBY (Figure 2), free bus transport of bicycles in the summer from Slovenian Istria to Karst on the »KoloBus« and on the route between Štanjel and Devin, have also contributed to a better indicator value for the municipality of Komen compared to those of Tolmin and Kobarid. In all three municipalities, it is necessary to expand the existing cycle trails and arrange appropriate signage and infrastructure (bicycle parking spaces, bicycle service, cyclist-friendly accommodation, adjusted offers and an increased availability of public transport). It is necessary to make better use of the exceptional potential for cycle tourism, which all three municipalities have owing to their rich natural and cultural heritage.



Figure 2: Electric bicycle rental system in Štanjel.

Regarding economic indicators, i.e. the number of tourists, the number of overnight stays and the number of accommodation facilities according to the 2011–2020 data provided by the Statistical Office of the Republic of Slovenia (Tables 3–5), we found that all indicators are exceeded at the peak of the summer season in all three municipalities. The number of overnight stays increased significantly in the period 2011–2019, namely in the municipalities of Kobarid by 108%, Tolmin by 269% and Komen by 149%. During the same period, the number of overnight stays in Slovenia increased by 51%. In the period 2011–2019, the number of beds increased in Kobarid by 81%, in Tolmin by 398% and in Komen by 75%. In all three municipalities, there is a shortage of accommodation facilities during the summer season. All three destinations generally offer accommodation with smaller capacities: in the municipalities of Tolmin and Komen there are private rooms and apartments, and in Kobarid there are also campsites. Everywhere, however, there is a shortage of smaller hotels to accommodate larger coach parties who arrive by bus to their destination and have to be directed to other municipalities. It is therefore necessary to encourage investors to invest in additional accommodation facilities to establish a structural balance (smaller hotels, dispersed hotels, glamping, tourist farms and eco-accommodations). Improved quality and consequently higher prices can contribute to the management of mass tourism. It is necessary to create new tourist products in order to deseasonalise tourism and to prolong the length of stay of tourists outside the season. If registration was better controlled in respect of guests and payment for the use of general infrastructure services and if illegal camping was prevented, especially in the municipalities of Tolmin and Kobarid, more efficient destination management would be possible.

With the aid of nine selected indicators, we found that the best assessment of the carrying capacity was given for spatial and ecological indicators: the quality of surface water in the Soča river basin, in the case of the Posočje municipalities of Tolmin and Kobarid, and the protected natural areas in the case of the Karst municipality of Komen, with its collection and treatment of waste and the supply and consumption of potable water.

Infrastructure indicators have proved to be the weakest aspect with all the groups, so municipalities will need to ensure there is a rapid improvement of the infrastructure if they want to continue to develop as successful and sustainable tourist destinations. Improvements are needed both in the field of tourism infrastructure and general infrastructure. All three indicators, i.e. parking spaces, the length of renovated local and state roads and cycle trails were assessed as having exceeded their margins. In addition to expanding and providing adequate infrastructure, municipalities can also improve when it comes to learning from

Table 3: Number of beds in the municipalities of Tolmin, Kobarid and Komen from 2011 to 2020.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Kobarid	1968	2045	1986	2050	2303	2337	2376	–	3564	4116
Tolmin	1427	1491	1788	1892	1869	1980	2279	–	7106	4087
Komen	167	175	151	175	165	142	190	–	293	–

Table 4: Number of tourists in the municipalities of Tolmin, Kobarid and Komen from 2011 to 2020.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Kobarid	38,368	37,744	37,051	33,137	42,248	44,227	54,487	67,698	79,915	57,513
Tolmin	14,225	15,773	20,723	21,521	25,939	29,034	36,093	56,446	61,809	44,142
Komen	1660	1585	1675	2027	2146	2326	3565	4787	5220	–

Table 5: Number of overnight stays in the municipalities of Tolmin, Kobarid and Komen from 2011 to 2020.

	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Kobarid	97,350	99,249	97,457	83,964	103,731	110,909	141,295	186,187	202,297	158,011
Tolmin	43,652	48,719	59,694	65,601	75,653	80,954	101,039	157,852	161,160	119,228
Komen	4439	4130	5435	4882	4582	4748	6515	10,968	11,051	–

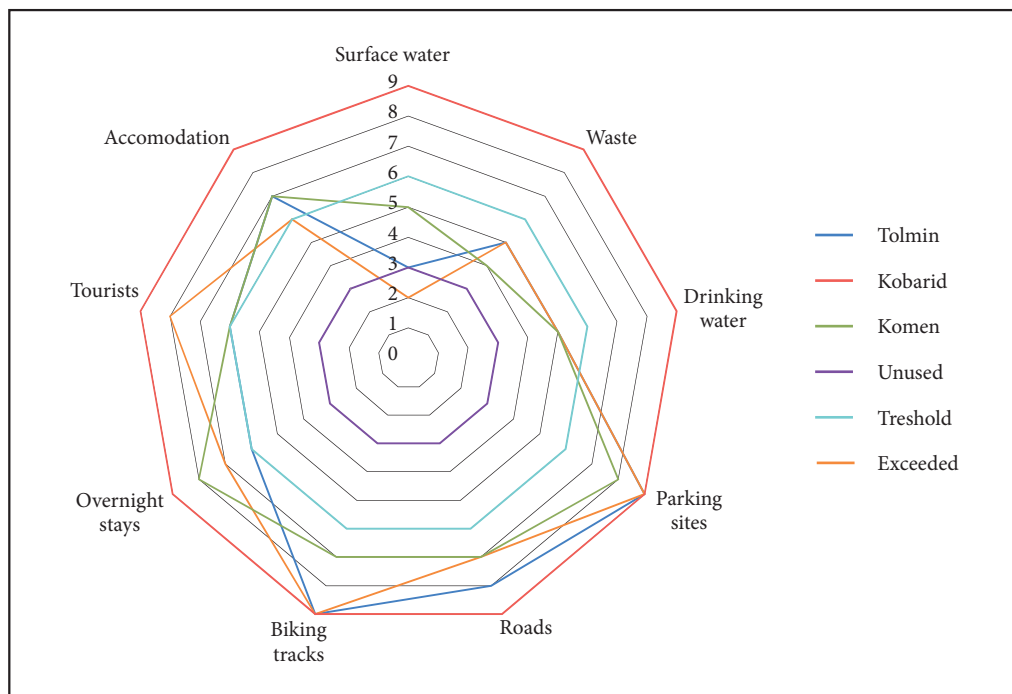


Figure 3: Carrying capacity of the municipalities of Tolmin, Kobarid and Komen.

other cases of good practice at home and abroad in the area of introducing sustainable mobility. It is also necessary to monitor spatial-ecological indicators that have not exceeded margins and to maintain their favourable status and to make even better use of the potential of the available unused surface water in the Soča River basin.

4 Discussion

This research represents an important contribution to testing the comprehensive assessment method on the carrying capacity for tourism. It differs from partial assessments of carrying capacity, where spatial-environmental or socio-cultural carrying capacities for beaches (Tselentis, Prokopiou and Toanoglou 2006; Tselentis et al. 2006; Zacarias et al. 2011; Corbau et al. 2019) and destinations (Manning 1999; Mavri 2018a, 2018b; Jurinčič 2020) of natural and cultural heritage were analysed (Bertocchi et al. 2020; Camati et al. 2020; Bertocchi, Camatti and van der Borg 2021). In our case, in contrast to the methodology designed by UNEP and World Tourism Organization (Klarič et al. 2003) and the EU (Coccosis, Mexa and Collovini 2002) we divided the group of spatial-environmental indicators into two groups, namely spatial-environmental and infrastructural, covering the general infrastructure. We found that infrastructure indicators play a key role in assessing the carrying capacity for tourism. Also, in other tourist-developed countries (Klarič et al. 2003; Klarič and Marković 2013), it is evident that infrastructure indicators are the most critical group in further ensuring the sustainable development of tourism. When Soča Valley acquired the Gold Label award as a Slovenia Green Destination, an area which includes the municipalities of Tolmin and Kobarid, and Karst-Brkini, which also includes the municipality of Komen, the results were similar. Otherwise, ratings were lowest in the field of infrastructure (7 out of 10), which enables effective protection of the environment, such as waste and wastewater management, sustainable mobility and reduction of fossil fuels (ORA 2021). The implementation of the proposed measures to increase the carrying capacity of infrastructure indicators, which represent the weakest link, and to evaluate their effectiveness on an ongoing basis is essen-

tial for sustainable tourism development. Otherwise, the destinations in question will lose their gold labels awarded by the Slovenian Tourist Board's Green Scheme, which addresses all the pillars of sustainable tourism development and has an important promotional effect for the destinations of the Soča Valley and Karst-Brkini (Razpotnik Visković 2020).

Our findings regarding the exceeded carrying capacity of infrastructure and economic indicators were taken into account when developing new sustainable tourism development strategies for the municipalities of Tolmin and Kobarid within the destination area of the Soča Valley (Zupan et al. 2020) and for the municipality of Komen within the area of Kras-Brkini (Piciga, Prašnikar and Radić 2021).

If conditions change and with appropriate strategic management, the determined carrying capacity can be increased or reduced by imprudent behaviour or inadequate tourist development. This can happen in the future, for example, in the case of the potable water supply and consumption indicator, which currently has not exceeded its indicator in any of the municipalities in question.

Water consumption in tourism is becoming one of the key indicators of the carrying capacity of tourist destinations. With the increase in the number of overnight stays, the consumption of potable water will also increase as tourists are high consumers of water. One of the accommodation providers in Tolmin recorded a consumption of 398 litres of water per night (Hvala 2018), and an accommodation provider in the municipality of Kobarid reported 366 litres (Volarič 2020). Both are high and comparable to the water consumption at hotels in Slovenian Istria, where it averages 350 litres per night (Jurinčič and Bojnec 2009) and is significantly higher than the consumption of the local population, which in 2020, according to the data provided by the Statistical Office of the Republic of Slovenia, amounted to 159 litres per person and has been fairly stable for the last ten years. Climate changes must also be taken into account, which are also reflected in problems with a potable water supply (Cigale 2007; Scott 2021). Therefore, it is necessary to take appropriate measures to reduce the water consumption of residents and tourists (Baños Castiñeira and Viñals Blasco 2020), which also applies to the municipalities of Kobarid, Tolmin and Komen.

The method of using carrying capacity as a standard was very useful in practice when managing visits to natural and cultural heritage sites, and at municipal and regional level when preparing sustainable tourism development strategies. It also serves as an appropriate aid in adopting spatial planning strategies when locating tourism infrastructure in an area. In future, we believe it shall be possible to upgrade the carrying capacity method for tourism by using big data to monitor tourist visits in real time, which is already used in some UNESCO heritage destinations, such as Venice, Dubrovnik and the Dolomites (Bertocchi et al. 2020; Camatti et al. 2020; Bertocchi, Camatti and van der Borg 2021). With the aid of modern communication technology, we can also obtain more accurate data on day visitors and their movements and behaviour at a given destination. In this way, we could solve the problem of researching the carrying capacity where there is a lack of data regarding unregistered guests and one-day visitors, which is also a burden on the infrastructure.

The impact of the process of carrying capacity analysis on the local population, the tourist economy and the local administration is also very important. With their active involvement, this process can also educate and raise awareness of the importance of sustainable development. Sustainable development of tourism is possible in the long term only in cooperation with the local community, and it should be pointed out that it is necessary to involve local residents at an early stage of development and spatial planning (Nared et al. 2015; Gabrovec et al. 2017).

5 Conclusion

The carrying capacity method for tourism is an appropriate tool for promoting sustainable tourism and identifying limitations at a destination that must be taken into account in the context of further development. By carefully scrutinising individual indicators, we were able to determine whether their current carrying capacity had already been exceeded or not.

When exploring the carrying capacity for tourism in the municipalities of Tolmin, Kobarid and Komen, where tourism has increased significantly in the last decade, we found that the most problematic aspects are infrastructure and economic carrying capacity, and most factors have recorded excessive values during the summer season. The most favourable is the spatial-environmental carrying capacity, where no factor analysed had been exceeded.

The number of overnight stays in these municipalities had increased to above average in the period 2011–2019, both in relation to the average growth for the entire area of Slovenia (51%) and by the type of

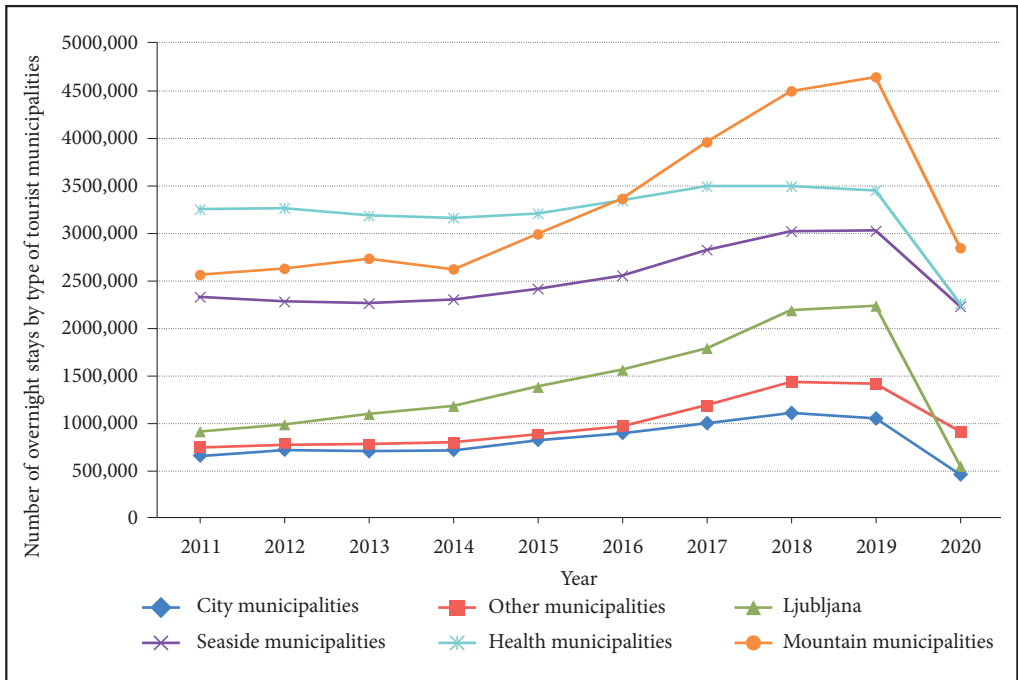


Figure 4: Number of overnight stays by type of tourist municipalities from 2011 to 2020.

tourist municipalities. The increase was 108% in the municipality of Kobarid, 269% in Tolmin, and 81% in the mountain municipalities. The growth of overnight stays in Komen (by 149%) also exceeds the average growth in other municipalities (92%) to which it belongs (Figure 4). There has been a more pronounced increase in the number of overnight stays in all municipalities since 2015 (Cigale 2019).

A record number of tourists who visited in the 2019 tourist season has highlighted the problem of overtourism, but this can be solved with appropriate management and the participation of all stakeholders. With the unexpected growth in the number of tourists visiting, we found that the municipalities are not adequately prepared for the increased growth in the tourism sector. Therefore, on the basis of the carrying capacities identified for various individual indicators, we have proposed measures to increase their carrying capacity or to maintain it at a level where it does not exceed in the future.

The results of the carrying capacity assessment for the municipalities in question for tourism should not be considered as a tool to severely restrict the development of tourism, but rather as an expert recommendation that will lead the development of tourism, in some areas, to another more sustainable direction or will transform it appropriately.

This research has some shortcomings, which in our opinion are outweighed by the contribution that has been generated by the otherwise partial subjective assessment. The analysis did not include all the factors which influence the assessment of the carrying capacity, but only nine key indicators that, we believe, are important when determining the capacity of the municipalities of Tolmin, Kobarid and Komen for tourism.

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