Urban Strategies for Waste Management in Coastal Areas

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Abstract
Europe is the most visited region in the world, the destination for half (49.8%) of the 1.24 billion international tourist arrivals in 2016. Almost half (47.4%) of European tourist visits occurred in coastal regions, defined "*on the basis of and consist of local administrative units or municipalities that border the sea, or have at least half of their total surface area within a distance of 10 km from the sea.*" In 2015, 9 out of 10 nights spent at Tourist Accommodation Establishments (TAE) in Malta, Cyprus, Greece, Croatia and Denmark were located at coastal areas, while the overall flow of tourism in the EU is primarily concentrated on Mediterranean coastal regions. Within this research, the concept of urban metabolism will be used to understand and analyses how tourist areas that are influenced by tourism use their resources and how touristic activities are linked to waste management and resource conservation. Furthermore, a waste compositional technique has been performed in order to relate the waste production in coastal areas as well as the level of the pollution link to the sea and moreover to evaluate the existing infrastructure and waste management plan.
Keywords: Area Metabolism, key permeance indicators, waste strategies, accumulation rate, waste compositional analysis.

1. Introduction

The development of Tourist Industry is part of global tourism trend. The most widely tourism development model used in the region is based on seaside summer holidays and attainment of quantitative goals (Zorpas et al., 2008). Tourism provides substantial contributions to local economies by creating employment and investment opportunities, but rapid growth has been the main cause for many adverse social, environmental and economic impacts. Hotels constitute a key element of the organized chain of activity in the travel and tourism industry, and occupy a crucial place in concerns over environmental protection related to tourism and travel (Zorpas et al., 2015). Tourist Accommodation Establishments reflects both the length of stay and the number of visitors and is considered a key indicator for analyzing the tourism sector. According to initial Eurostat estimates, there were

approximately 3.2 billion nights spent in EU-28 tourist accommodation in 2017. To assess tourism sustainability levels, Eurostat uses Tourism Intensity (T.I) and Tourism Density (T.D). T.I are the nights spent in TAE in a year per 1.000 inhabitants (the EU-28 average was 5.292 in 2015) therefore reflects both the length of stay and the number of visitors and is considered a key indicator for analyzing the tourism sector (Figure 1). According to initial Eurostat estimates, there were approximately 3.2 billion nights spent in EU-28 tourist accommodation in 2017. T.D are the nights spent in TAE in a year per region km^2 (the EU-28 average was 597 in 2015), as "measures that may be used to analyses sustainability issues linked to Tourism Pressures."
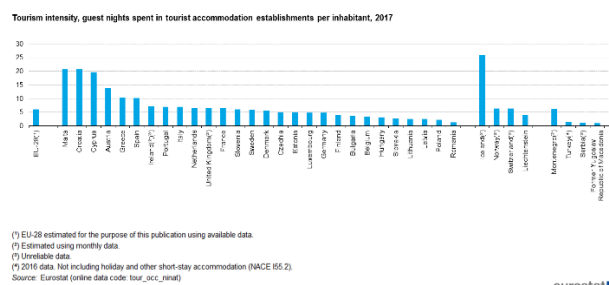
Figure 1. Tourism Itensity according to Eurostat 2017

2. Material and Methods

The main objective of the research was the waste compositional analysis into the coastal Zone in order to determine the degree of visitors' participation in the waste generation and to define their habits as well as to evaluate the existing waste management plan of solid waste applied in each. Moreover the Clean Cost Index (CCI) and the Accumulation Rate (AR) and Accumulation Index (AI) were calculate. CCI is a tool developed by Alkalay et al. (2007) to evaluate the cleanliness of a beach. It is calculated as follow: $CCI=(NIcol/S)\times K$, where CCI is the clean-coast index, NIcol the number items collected on the fixed portion of beach, S the surface of the fixed portion of beach in m2 and K is a constant that equals to 20. AR of the marine litter of a given item per unit of surface and per unit of time. AR can be given in number of items/m^2/day and $AR=NIcol /$

S / T, S the surface of the fixed portion of beach in m^2 and T the time elapsed between the survey and the last cleaning activity in days. (AI) takes into account the accumulation rates of the marine litter and can be calculated as follow and $AI=\log10(AR\times1000000)$.

3. Results and Discussions

Table 1 presents the waste compositional analysis of the costal area

Table 1. waste analysis in costal areas

Papers and callboards	5.70%
Glass	10.80%
Plastics	28.91 %
Organics (mainly Food waste)	20.41
Cans (mainly Al)	6.71
Others	27.41

The CCI (Table 2) was 3.4 for low season (from October to April) while from May to September the CCI increased to 4.2 and this may characterized the area as "clean" while the AI is moderated for the low season (AI=3.7 from October to April) and is characterized as high for the summer season(AI=4.8 from May to September) (Tabl2).

Most Mediterranean islands cannot manage and they have lack of infrastructures to treat continual increased of waste generation during the tourist season (May – September). Some of the waste generated in coastal areas resulted into the sea due to insufficient, uncontrolled and not quite attractive collection points (Figure 2).

Table 2. CCI, AI, AR indicators

	CCI	AI	AR (items/km2/day)
Very clean	0-2		
Clean	2-5		
Moderate	5-10		
Dirty	10-20		
Very Dirty	20+		
Extremely Low		≤1	1
Very Low		1-2	10
Low		2-3	100
Moderate		3-4	1000
High		4-5	10000
Very High		5-6	100000
Extremely High		≥6	1000000

Figure 2. Insufficient collection points in coastal areas

4. Conclusions

The United Nations World Tourism Organisation defines sustainable tourism as tourism that meets the needs of present tourists and host regions while protecting and enhancing opportunities for the future. Coastal zones are recognized of 'strategic importance to all Europeans and several action must be including in local lever to reduce littering into the sea. For example, hotels must changed their one use items with refilling's ones, plastic straw and plastic bottles of water must no be used and changed with refiling bottles from glass and stainless steel straws. Also local authorities may increase the collection time of waste bins from the beach and just once a day and also to promote and design more attractive bins with higher volume.

References

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