

Full Length Research Paper

Estimation of Beach Carrying Capacity for Lakshadweep Islands South India

Raheem, P.,¹ Vincy M. V.,^{2*} Brilliant R.³ and Jude, E.³

¹Research Scholar, Research & Development centre, Bharathiar University, Coimbatore, Tamil Nadu, India. Journal No: 47359

^{2*}Department of Zoology, St. Berchmans College, Changanacherry, Kerala, India.

³Department of Environmental Sciences, St. John's College, Anchal, Kerala, India.

Article history

Received: 11-09-2017

Revised: 16-09-2017

Accepted: 17-09-2017

Corresponding Author:

Vincy M. V

Department of Zoology,
St. Berchmans College,
Changanacherry, Kerala,
India.

Abstract

Tourist activity has played an important role in global economic activity, and tourism industry has been the important industry that many countries make effort to develop. Lakshadweep group of islands are unique for its natural landscape and scenic beauty. It has good tourism potential, which attracts both the domestic and international tourists each year. Increasing tourism pressures put forth negative impacts on social-cultural and natural environment of the island. So, better understanding regarding tourism carrying capacity (TCC) as an environmental management tool is needed to maintain the exploitation and conservation ratio of the Island. In the present study estimation of beach carrying capacity being the central objective of this research, has been highlighted in the light of the environmental management and planning of the island. Three main beaches namely Kavaratti, Agatti and Kadmat Islands have been selected as study stations. Tourism capacity has been determined by means of Physical Carrying Capacity (PCC), Real Carrying Capacity (RCC) and Effective Carrying Capacity (ECC). Kadmat and the north western beaches of Kavaratti have the highest and lowest RCC and PCC respectively in the island.

Keywords: carrying capacity, tourist destination, management

Introduction

Tourism is a fast growing industry and a valuable sector, contributing significantly to the local economy and society making it an important economic, social and cultural activity in many societies, both in developed and developing countries (Le-Klähn & Edwards, 2014; Telfer & Sharpley, 2007). Tourism has the potential to generate employment opportunities, create regional and local investment, provide local people with trade opportunities and support other economic sectors within a destination zone (Lin & Mao, 2015; Pappas, 2014; Ryan, 2003). Tourism development affects both host communities and tourists negatively and positively (Ritchie & Crouch, 1993). The social and cultural nature of tourism leads to socio cultural change in local communities. Social carrying capacity which is the maximum visitor density in an area at which the tourists still feel comfortable and uncrowded (De Ruyck et al., 1997) needs to be managed if a community is to continue benefiting from tourism and minimizing the negative effects of tourism. In the light of climate change and increasing global population there is increasing risk of host tourist conflict in areas of interface (Korstanje, 2009; Tarlow, 2014). Analogous to Butler (2006) tourist area life cycle, when the carrying capacity of a destination is reached it ceases to be attractive for new business and repeat business leading to decline in tourist arrivals. Destination managers worry about the sustainability of the destination and its ability to satisfy the current and future hosts and tourists of a destination (Erkus-Ozturk & Eraydin, 2010).

World Tourism Organization (WTO) in 2005 declares that tourism operations in protected areas need to be carefully planned, managed and monitored to ensure their long-term sustainability. Otherwise, such operations will have negative consequences, and tourism will contribute to the further deterioration of these areas. While the negative effects of tourism are of significant concern, many protected areas have promoted tourism development to improve their economic conditions, particularly in generating revenue to finance other social and economic development activities and to provide direct income and employment opportunities for local people (WTO, 2005). Every developmental activity leads to environmental change (positive or negative) and tourism is no exception to this (Buckley, 2009). Tourism often has the potential to cause of environmental degradation and loss of local identity and traditional culture (Syamlal, 2008). The environment of the destination is negatively influenced by the increase of tourism (Gosling, 2002; Ramdas & Badaruddin, 2014), whereas the growth of tourism depends on the quality and characteristics of the environment. As tourism activities become more widespread, there tend to be marked changes in the environment (Smith, 1989), the capacity to absorb

large numbers of people will be challenged (WTO, 1990). However, the degree of environmental impact varies, depending on the type of tourist and the intensity of site use (Gartner, 1996).

Starting as early in the 1960s, outdoor recreation research used the concept of Tourism Carrying Capacity (TCC) to address the resource and social effects of visitor use (Manning et al., 1999; Lawson et al., 2003). The concept has been adopted by researchers and managers in the context of tourism and environmental sciences to address financial resources and avoid negative social impacts (Manning et al., 1996). It mainly includes ecological and social parameters, such as environmental quality and visitor experience respectively. Clearly, the basic element of this concept is the need to establish a limit on tourist activity that reflects the concerns and priorities of local managers and planners (Mexa & Coccossis, 2004). By the early of 1990, the concept of TCC was largely replaced by the idea of sustainable tourism, but many of the challenges outlined for this new concept are similar to past issues concerning TCC in terms of definition of objectives, practices, utility and diversity of types (Jurado et al., 2012). Sustainable tourism is defined as the “tourism which is economically viable but does not destroy the resources on which the future of tourism will depend, notably the physical environment and the social fabric of the host community” (Swarbrooke, 1999). The discourse on sustainable tourism development revolves around a central issue of how to manage the resources of host communities in order to meet the fundamental criteria of promoting their socio-economic wellbeing while satisfying the needs of tourists (Ko, 2001). The concept of TCC occupies a key position with regard to sustainable tourism (Tribe et al., 2000). It is interpreted as an application of sustainable tourism, implying that the two can co-exist and could be useful frameworks for analyzing the impacts and limits of development (Butler, 1996). Over the years, TCC has been evaluated for individual tourist destinations around the world (Barancok & Barancokova, 2008; Lone & Malik, 2013; McCool & Lime, 2001; Nghi et al., 2007; Sayan & Atik, 2011; Malik & Bhat, 2015). It is suggested that destinations should not be developed beyond their innate capacities for tourism. Despite the limitations associated to the TCC concept, it has been described as an appropriate tool for management, as it enables the preservation of resources (Queiroz et al., 2014). Although not always consensual, the TCC assessment remains one of the most useful and applied techniques (Zacarias et al., 2011) for tourism and recreation planning, and management, especially if combined with other management tools (Queiroz et al., 2014). Much consideration has recently been given to increase in coastal population, with the implication that the carrying capacity of the world’s coast is finite and such considerations form part of several coastal management initiatives (UNEP, 1996). Johnson and Thomas (1996) argue that the present interest in tourism capacity is due to growth in tourism combined with increasing awareness of environmental issues. The concept is particularly important in the coastal zone which is undergoing rapid change as a result of demographic changes and industrialization in the context of global climate and sea-level change. In its broadest sense, carrying capacity refers to the ability of a system to support an activity or feature at a given level. Tourism carrying capacity is defined as “the maximum number of people that may visit a tourism destination at the same time, without causing destruction of the physical, economic and social-cultural environment and an unacceptable decrease in the quality of the visitor satisfaction” (WTO, 1981). TCC can also be defined as “the maximum number of people that use tourism site without unacceptable effect on environmental resources while meeting the demand” (Hens, 1998). It is the highest bearing capacity of a natural, environmental and socio-economic system beyond which facilities are saturated (physical carrying capacity), the environment is degraded (environmental carrying capacity) or visitor enjoyment is diminished (perceptual or psychological carrying capacity) (Pearce, 1989). Mexa and Coccossis (2004) indicated that despite several criticisms, carrying capacity assessment remains a powerful concept that can be used for planning and management of sustainable tourism. Segrado et al. (2008) reported that apart from outlining all factors that limit tourism growth, the concept of carrying capacity also indicates compensatory tool to manage tourism flows to a destination, whilst Bonilla and Bonilla (2009) indicated that this concept should be seen as a positive and dynamic prism contemplating the temporal space as a basic value for implementation of sustainable beach management principles.

Understanding that good beaches are worth billions of tourist dollars and degraded beaches are worth little (Clark, 2005), the main objective of this paper is to assess the recreational carrying capacity of Neil Island by means of assessing the physical carrying capacity (PCC) (assuming that every beach has a limiting size of people that it can accommodate), real carrying capacity (RCC) and the effective carrying capacity (ECC). To meet the objective, three major research questions were developed: (1) what is the maximum number of people that should be allowed at Neil Island? (2) Has the Tourism carrying capacity at the beach been exceeded or is it still in the optimum range? And (3) what is the optimum allowed number of people on the beach?

Materials and Methods

Study area

Lakshadweep, a group of coral islands located in the Arabian Sea off the west coast of India, forms an integral part of Chagos-Maldivo-Laccadive Ridge in the Indian Ocean (Fig 2.1). The Lakshadweep group of islands is the smallest Union Territory of India. It has 36 islands and islets consisting of 12 coral atolls, 3 reefs and 5 submerged banks lying between Latitudes of 8 to 12° 30' N and Longitudes of 71 and 74° East (Mannadiar, 1977). The geographical area of the entire group of islands put together is 32 km² with a coastline of length 123 km and lagoon area of 4,200 km².

Kavaratti islands have a tropical humid, warm and generally pleasant climate, becoming more equatorial in the southern islands of the territory. Southwest monsoon period is the chief rainy season which lasts from late May to October. April and May months are the hottest with the mean minimum and maximum temperatures of 26.8°C and 33.1°C respectively. December and January are the coldest months with the mean minimum and maximum temperatures of 24°C and 31.1°C respectively. Vegetation intercepts part of rainfall

and causes transpiration to occur. Interception and transpiration tend to decrease recharge and hence, decrease the available groundwater resource. Depending on the depth to water table and type of vegetation, direct transpiration losses from groundwater aquifers can increase. In Lakshadweep islands, the variability of evapotranspiration is much lower than that of rainfall. Typical annual values of potential evapotranspiration in the islands are between 1600 mm and 1800 mm.

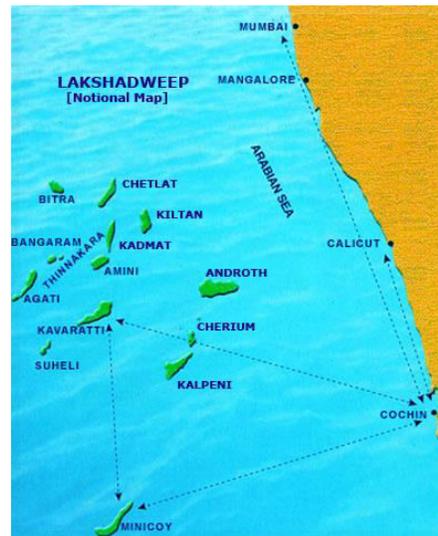


Fig. 1: Study area

The general formula of Carrying capacity assessment for protected areas was first proposed by Cifuentes (1992) and further applied in different fields by many other authors (Amador et al., 1996; Ceballos-Lascurain 1996; Arias et al., 1999; Munar, 2002; Nghi et al., 2007; Segrado et al., 2008; Zacarias et al., 2011). In the present context the method has been applied with some modifications.

Tourism carrying capacity is divided into the following levels:

Methodology

Physical Carrying Capacity (PCC)

Definition: PCC is the maximum number of tourists that can physically fit into or onto a specific area, over a particular time.

$$\text{Formula: } PCC = A/A_u \times Rf$$

Where: PCC = Physical carrying capacity, A = Available area for tourist use, A_u = Area required per tourist, Rf = Rotation factor (number of visits per day)

Total area (A) of three islands was measured during the field study (Table 1). Considering the area of three beaches, an optimum area required per tourist (A_u) is 5 m² and rotation factor (Rf) is determined by:

$$Rf = \text{Daily open period} / \text{average time of visit}$$

(According to WTO (1998), a beach should not have more than 1000 people per hectare. Therefore, each beach tourist should have at least 10 m² of the beach area)

Real Carrying Capacity (RCC)

Definition: The maximum permissible numbers of tourists to the specific site, once the Correction factors (CF) derived from the particular characteristics of the site have been applied to the PCC.

$$\text{Formula: } RCC = PCC \times (Cf_1 \times Cf_2 \times Cf_3 \times Cf_4 \times \dots \times Cf_n)$$

Where: RCC = Real Carrying Capacity, PCC = Physical carrying capacity, Cf = Correction factors

Correction factors are calculated using the following formula.

$$Cf_x = 1 - Lm_x/Tm_x$$

Where: Cf_x = Correction factors of variable x, Lm_x = Limiting magnitude of variable x, Tm_x = Total magnitude of variable x.

Correction factors are so important for estimating the Real Carrying capacity. The correction factors are obtained by considering the biophysical, environmental, ecological, social and management variables (Zacarias et al., 2011). Tourism is dependent on nature, so some variables are considered as correction factors for this study. Rainfall, excessive sunshine, cyclone and beach quality are the correction factors which can limit the tourism activities and decrease tourists' satisfaction at certain place. Therefore, correction factors are also known as limiting factors of tourism. Calculations of correction factors for different limiting variables are described below.

Effective Carrying Capacity (ECC)

Definition: The maximum number of tourists that a site can sustain, given the management capacity (MC) available.

Where: $ECC = \text{Effective Carrying Capacity}$, $RCC = \text{Real Carrying Capacity}$, $Mc = \text{Management capacity}$

Management capacity (Mc) defined as the sum of conditions that the beach tourism management requires if it is to carry out its functions and objectives. It is so difficult to measure the Mc. Determination of the Mc was based on the available infrastructures, facilities, amenities, legislation, equipment, staff capacity and budget. Mc was assessed through perception study of beach user and evaluating the study during the field work. All datasets were collected from several literature studies, direct field surveys, questionnaire survey and from the perception based study of the beach users and tourists during the field visits in the islands.

Results and Discussion

Kavaratti Island

Kavaratti Island has a total shore length of 14.72 km. The long-term shoreline changes in the Kavaratti Island indicate that about 36% of Kavaratti is affected by erosion, 61% of the shoreline is accreting and the rest is stable. Many coastal areas which are severely affected by erosion have been protected by shore protection structures using hollow concrete blocks and tetrapods (http://www.lakshadweep.nic.in/documents/SnT_Notice/Kavaratti/Kavaratti.pdf). The southern part and south western stretches have good number of coral/white sandy beaches; some portion of this area has been occupied /identified for defense unit such as Coast Guard, Navy, IRB, CRPF, etc.

The identified area for tourism development in IIMP of Lakshadweep administration is the northwest part of the island that is the area from the SPORTS HUT to PORT CONTROL TOWER. Even though this area being identified in IIMP is unsuitable for utilizing the entire area for tourism activity since a major portion of this area practice traditional fishing. A good number of local population (communities) in the islands is dependent on fisheries and coconut farming for their livelihood. Therefore there is a chance of conflict to exist between tourist and fishermen for resources such as beach space while implementing tourism in traditional fishing beach areas. Kavaratti has a total of 565 full time active fishermen and 995 part time/occasional fishermen in 2009-10 periods (Source: Report on BSLLD (urban) pilot in Lakshadweep, 2014 of dept of planning and statistics, UTL). The population density of the island score eighth rank in 1951 (682/ km²) and second rank in 2011 (2656/km²) among the inhabited islands of Lakshadweep, which marked a considerable increase over years.

Fishing and coconut farming is the livelihood of a large number of local populations. Therefore traditional fishing areas and beach areas used for coconut drying should be kept free from tourism to hang net, to beach their boats, to dry fishes, etc. All fish and fishery related activities require coastal land and beach areas, therefore land area should be available for fish processing and value added fish processing plants and fisheries related all future activities (both for government and private parties). Tourism activities in this densely populated island should not affect the right of public access to beach and local tourist enjoyment opportunities. At present only limited accommodation facilities for tourist is available in Kavaratti Island. There is lack of suitable land area for further improvement of accommodation infrastructure/tourist resorts in Kavaratti Island due to limited land availability and high population density. Hence the present tourism conducting beaches such as sports hut beach and sandy beach (near port control tower) should only be permitted for tourism activity in the north western part of the island. The south western part of the island has comparatively good quality white sandy beaches, crystal clear water, shallow lagoons and low populated area than the north western beaches. Tourism activity in this area may not create much negative impact to local population and fisherman community and the island culture. But the area so far not utilized for tourism related activities. Even this area is not properly mentioned in the IIMP final report 2014, this area need to be considered for tourism activity. Therefore two beach portions in the north west part such as SPORTS HUT Beach, Sandy beach and beach area in the south western part (Western beach area from Power house to south end of Naval Base) prefer to select for beach carrying capacity assessment for tourism in a sustainable manure in this island.

Agatti and Kadmat Island

In the Integrated Island Management Plan (IIMP) of Lakshadweep administration, the area considered for tourism development in Agatti and Kadmat Island is the uninhabited or sparsely populated southern portion of the island, hence tourism activity in this area may not negatively affect the local population and fisherman community. Both these islands have a good tourism potential with its natural beauty and white sandy beaches, crystal clear water, shallow lagoons, rich marine wealth, variety of coral ecosystem and water sports activities.etc.

All visitors to Lakshadweep for tourism as well as any other official duties require 'Entry Permits' from Lakshadweep Administration. Tourism activities in the islands are currently conducted in a controlled manner through a few specific tour packages sponsored by SPORTS (Society for Promotion of Nature Tourism and Sports). SPORTS was set up as a registered society under the Societies Act. Being controlled, the travel, stay and food are taken care of by the sponsor. These packages depend on the travel schedule of a few ships now plying between Kochi and the island. In another inhabited island Agatti; SPORTS had established the resort facilities which are managed by private parties (<http://tourism.gov.in/sites/default/files/Lakshadweep.pdf>). The coral island is highly fragile and sensitive to even slight changes in the ecosystem. Increased arrival of tourist in this island will lead to over exploitation of natural resources and will pollute the environment and ultimately endanger the very base of island ecosystem. The availability of clean drinking water is the major issue. There is no surface water available in this island. Limited ground water is the only source available

for humans and other living beings. Thickness of fresh ground water layer is very thin; hence the ground water extraction has to be adjusted to sustainable level. Fresh ground water layer has already been deteriorated in many areas of these islands with saline water intrusion. The demand of water at present is being met from ground water resources, rain water harvesting and through desalination process. Presently desalination plants are available only in Kavaratti and Agatti Island, and one proposed for Kadmath Island.

In order to investigate the physical carrying in the study area based on applied approach, it is needed to calculate and assess required data, including a suitable area of tourism, area available per user, visit duration, etc. suitable area for tourism was determined differently by the extent of recreation zones (Table 1). The result of the field shows that Kadmat Island covers 58880 m², with the highest tourist potentiality. Considering all required data, physical carrying capacity was estimated for three beaches of Lakshadweep Islands and the results are shown in Table 2.

Island beaches are highly dynamic and sands migrate around the island in response to the reversing monsoonal influence. Lakshadweep has a tropical climate with summer temperature ranging from 35°C to 22°C and winter temperature at 32°C to 20°C. During the south west monsoon (May 15th to October 15th) sea conditions are very rough and consequently all sea based activities like fishing, ship travel, etc are restricted. Only little big ship can travel during this season. Smooth tourism activities cannot possible in this season with present transportation and other infrastructural facilities. During monsoon season area of beach reduced and sometimes beaches are shifted to some other place. These are moving sands. The available beach area in peak season (May 15th to October 15th) is given in table 2.

PCC includes the maximum number tourist that can physically present at a certain time and place and should never exceed this range. Rotation factor is considered as an important indicator for the development of management strategies for beach tourism, as it influences the tourism capacity of a certain place (Bera et al., 2015). The RCC of Kadmat Island is 1178 visitors/day which is in other words have not exceeded the frequency of the maximum permissible number of people that should be allowed at the island. Snorkeling, scuba diving, game fishing, trekking, cycling, sun bathing, swimming and bird watching are the main tourist activities in the Island. Good beach quality offers maximum tourist activities because it has direct control on the satisfactory levels of tourist. Real Carrying Capacity is the maximum permissible number of tourist to a specific site. Considering the socio economic conditions and eco-fragility of coral reefs, the number of visitors has to be limited; the beach area for each tourist is limited to 50 m². Uncontrolled boating activity, sedimentation, coral collection, water pollution, collection of ornamental fishes and walking on reef flat causes breakage of corals. Boat anchoring and intense diving activity at a popular diving location causes high levels of coral destruction, only limited number of scuba divers can be permitted at a time.

The present study recommends only 30 divers should be allowed at a particular station at a time subsequent to proper training and awareness regarding the significance of coral ecosystem. RCC of Kavaratti Island, the north western beaches are 74 visitors/day and 169 visitors/day in south west beaches. RCC of Agatti and Kadmat are 547 visitors/day and 1178 visitors/day respectively. The available tourist accommodation in all the three islands is well below the real carrying capacity of the island. As the case of Kavaratti island there is no space for further developing accommodation facilities for tourist due high population density and very limited land availability. Based on direct field survey, questionnaire survey, various literature study and perception based study of the beach users; the overall management capacity of Kavaratti Island is at present 70%. Due to the limited accommodation facility, instead of staying tourism more number of day tourism upto carrying capacity limits can be suggested for this island.

Agatti and Kadmat Island has suitable land available for further development of tourist accommodation facilities and other infrastructural development. As the available tourist accommodations are well below the Real Carrying Capacity (RCC) of these islands, need to be developed with ensuring environmental quality. Management capacity measurement of these islands is as difficult at this stage as these islands are on initial stage to developing the island to a world class tourist destination. The result indicates that each level constitutes a corrected capacity level of the preceding level. From this assessment it is clear to us that PCC is always greater than the RCC and RCC is greater than the ECC. ECC is more acceptable than two other types of carrying capacity. It is also useful for development of policy for beach tourism management, as it indicates the optimum number of tourists that should be allowed on the beach with existing condition and management capacity (Bera et al., 2015). Management capacity (MC) defined as the sum of conditions that the beach tourism management requires if it is to carry out its functions and objectives. It is so difficult to measure the Mc. Determination of the Mc was based on the available infrastructures, facilities, amenities, legislation, equipment, staff capacity and budget. Mc was assessed through perception study of beach user and evaluating the study during the field work (Bera et al., 2015).

Reddy (2007) have pointed out that any attempt to develop tourism on a large scale in the island would have harmful effects on the island ecology. It is argued that the opening up of the islands to tourists may cause an indiscriminate destruction of many unique and valuable species of flora and fauna some of which as alleged have already become extinct. Most serious concern in the islands is scarcity of fresh water during the time of havoc tourist inflow. The construction of the accommodation units must be encouraged which are environment friendly and must be concentrated on a particular site in order to easily manage solid and liquid waste generated from accommodation sectors.

Table 1: Areal coverage of beaches of Lakshadweep Islands

Sl. No.	Beach area	Length of beach (m)	Width of beach (m)	Area (m)	Total area (m ²)
Kavaratti Island					
1	Sports hut beach	60	28	1680	2580
		30	20	600	
		30	10	300	
2	Sandy beach	3	5	15	1144
		17	13	221	
		15	27	405	
		31	8	248	
		17	15	255	
3	South western beach (power house to south end of Naval base)	120	13	1560	8460
		345	20	6900	
Total Area = 12184 m²					
Agatti Island					
1	Airport to Satellite station (South west)	120	16	1920	16410
		180	27	4860	
		75	22	1650	
		120	27	3240	
		150	14	2100	
		30	8	240	
		120	5	600	
		90	20	1800	
2	Satellite station to Solar station (south west)	60	3	180	2340
		180	12	2160	
3	Airport to Solar (south east)	1075	8	1075	8600
Total Area = 27350 m²					
Kadmat Island					
1	Rifai palli to Sohali palli (south east)	270	10	2700	7890
		240	11	2640	
		150	17	2550	
2	Sohali palli to Helipad (south east)	330	8	2640	5050
		241	10	2410	
3	Helipad to Southern end (south east)	15	13	195	8410
		105	20	2100	
		90	12	1080	
		225	17	4335	
		70	10	700	
4	Rifai palli to Purakkata boomi (south west)	450	13	5850	6525
		135	5	675	
5	Purakkatu boomi to Sohali palli (south west)	255	9	2295	2295
6	Sohali palli to Tourist jetty (south west)	240	20	4800	9750
		165	30	4950	
7	Tourist jetty to Helipad (south west)	180	32	5760	5760
8	Helipad to Southern end (south west)	120	42	5040	13200
		255	32	8160	
Total Area = 58880 m²					

Table 2: Tourism carrying capacity of three beaches of Lakshadweep Islands

No.	Name of beach	Available beach area (sq. m)	PCC (visitors/day)	RCC (visitors/day)	ECC (visitors/day)
1	Kavaratti (North western Beach)	3724	372	74	52
	Kavaratti (South western beach)	8460	846	169	-
2	Agatti	27350	2735	547	-
3	Kadmat	58880	5888	1178	-

Conclusion

The concept of carrying capacity is particularly important in the coastal zone which is undergoing rapid change as a result of increasing anthropogenic pressure in certain natural environments. In its broadest sense, carrying capacity refers to the ability of a system to support an activity or feature at a given level. From very small to large types of systems are found in the coastal zone and these systems also support different types of activities. Tourism is a most practiced activity in the coastal zone and it may vary from one location to another. Over tourism have environmental, social, cultural and economic impacts. In the present situation for coastal resource management and planning among different approaches, tourism carrying capacity assessment remains one of the most useful and applied tool. The concepts of carrying capacities are related by the idea that each system has certain limits or thresholds and is not necessarily fixed in time. They are dependent on technology, preferences, and the structure of production and consumption. They are also varying with the changing nature of interaction between the physical and biotic environment. From the present study in Lakshadweep Island, it is found that, the present status of tourism activity is in lower level with its carrying capacity. Implementation of good infrastructure and management facility will help the Lakshadweep Islands to reach to its actual tourism carrying capacity (TCC) in the near future.

References

- Arias, M.C., Mesquita, C.A.B., Méndez, J., Morales, M.E., Aguilar, N., Cancino, D., Galo, M., Jolon, M., Ramírez, C., Ribeiro, N., Sandoval, E. and Turcios M. (1999) Capacidad de carga turística de las áreas de Uso Público del Monumento Nacional Guayabo, Costa Rica. WWF CentroAmerica, Costa Rica.
- Amador, E., Bliemsrieder, M., Cayot, L., Cifuentes, M., Cruz, E., Cruz, F. and Rodríguez, J. (1996) Plan de manejo del Parque Nacional Galápagos. Servicio Parque Nacional Galápagos. Instituto Forestal y de Áreas Naturales y Vida Silvestre, Puerto Ayora, Galápagos.
- Andereck, K.L., Valentine, K.M., Knopf, R.C. and Vogt, C.A. (2005) Residents' perceptions of community tourism impacts. *Annals of Tourism Research* 32(4): 1056-1076.
- Barancok, P. and Barancokova, M. (2008) Evaluation of the tourist path carrying capacity in the Belianske Tatry Mts. *Ekologia* 27(4): 401-420.
- Bera, S., Majumdar, D.D. and Paul, A.K. (2015) Estimation of Tourism Carrying Capacity for Neil Island, South Andaman, India. *Journal of Coastal Sciences* 2(2): 46-53.
- Bonilla, J.M.L. and Bonilla, L.M.L. (2009) La capacidad de carga turística: revision crítica de un instrumento de medida de sostenibilidad. *El Periplo Sustentable* 15: 123-150.
- Buckley, R. (2009) *Ecotourism. Principles and practices*. CABI publishing, Wallingford.
- Butler, R. (2006) *The tourism area life cycle (Vol. 1)*. Channel View Publications. New York. USA.
- Butler, R.W. (1996) The concept of carrying capacity for tourist destinations: Dead or merely buried. *Progress in Tourism and Hospitality Research* 2(3): 283-292.
- Ceballos-Lascuráin, H. (1996) Tourism, ecotourism, and protected areas: the state of nature-based tourism around the world and guidelines for its development. IV World Congress on National Parks and Protected Areas. IUCN, Protected Areas Programme.
- Cifuentes, M.A. (1992) Determinación de capacidad de carga turística en áreas protegidas. Biblioteca Orton IICA/CATIE, Costa Rica.
- Clark, J.R. (2005) *Coastal zone management handbook*. CRC Press, Inc., Florida.
- De Ruyck, M., Soares, A. G. and McLachlan, A. (1997) Social carrying capacity as a management tool for sandy beaches, *Journal of Coastal Research* 13(3): 822-830.
- Erkus-Ozturk H. and Eraydin A. (2010) Environmental governance for sustainable tourism development: collaborative networks and organization building in the Antalya tourism region. *Tourism Management* 31(1): 113-124.
- Gartner, W.C. (1996) *Tourism Development: Principles, Processes, and Policies*. New York: Van Nostrand Reinhold.
- Gossling, S. (2002) Global environmental consequences of tourism. *Global Environmental Change* 12: 283-302.
- Hens, L. (1998) *Tourism and Environment*, Free University of Brussels, Belgium.
- Johnson, P. and Thomas, B. (1996) Tourism capacity: a critique. In: Briguglio, L. (Ed.), *Sustainable Tourism in Islands and Small States: Issues and Policies*, pp. 118-136.
- Ko, J. (2001) Assessing progress of tourism sustainability. *Annals of Tourism Research* 28: 817-820.
- Korstanje, M. (2009) Re-visiting risk perception theory in the context of travel. *E-Review of Tourism Research* 7(4): 68-81.
- Lawson, S.R., Manning, R.E., Valliere, W.A. and Wang, B. (2003) Proactive monitoring and adaptive management of social carrying capacity in Arches National Park: an application of computer simulation modeling. *J. Environ. Manage.* 68: 305-313.
- Le-Klähn, D.T. and Edwards, D. (2014) Conference Report: The Best Education Network Think Tank XIII: Engaging Communities in Sustainable Tourism Development, Taylors University, Kuala Lumpur, Malaysia 2013. *J. Hosp. Leis. Spo. Tour. Educ.* 14: 1-5.
- Lin, L. and Mao P.C. (2015) Food for memories and culture – A content analysis study of food specialties and souvenirs. *J. Hosp. Tou. Manag.* 22: 19-29.
- Lone S., Lone F.A. and Malik A. (2013) Carrying capacity assessment for the promotion of ecotourism in Bangus Valley: A future tourist destination of J & K. India. *Int. J. Sci. Res.* 2(3): 187-188.
- Malik, M.I. and Bhat, M.S. (2015) Sustainability of tourism development in Kashmir - Is paradise lost? *Tourism Management Perspectives* 16: 11-21.
- Manning, R., Lime, D. and Hof, M. (1996) Social carrying capacity of natural areas: theory and application in the national parks. *Nat. Areas J.* 16(2): 118-127.

- Manning, R., Valliere, W., Lawson, S., Wang, B. and Newman, P. (1999) Carrying Capacity Research for Yosemite Valley: Phase II Study. University of Vermont/Studies Lab, Burlington, Park/Burlington.
- McCool, S. and Lime, D. (2001) Tourism carrying capacity: Tempting fantast or useful reality. *Journal of Sustainable Tourism* 9: 372-388.
- Mexa, A. and Coccossis, H. (2004) Tourism carrying capacity: a theoretical overview. In: Coccossis, H., Mexa, A. (Eds.), *The challenge of tourism carrying capacity assessment: Theory and practice*. Ashgate, England.
- Munar, F.X.R. (2002) Análisis de capacidad de carga en los espacios litorales, calas e playas, situados en áreas naturales de especial interés de la isla de Menorca / Francesc Xavier Roig i Munar. Almería, Universidad de Almería, Servicio de Publicaciones.
- Jurado, E.N., Tejada, M.T., García, F.A., González, J.C., Macías, R.C., Peña, J.D., Gutiérrez, F.F., Fernández, G.G., Gallego, M.L., García, G.M., Gutiérrez, O.M., Concha, F.N., R. de la Rúa, F., Sinoga, J.R. and Becerra, F.S. (2012) Carrying capacity assessment for tourist destinations. Methodology for the creation of synthetic indicators applied in a coastal area. *Tour. Manage.* 33: 1337-1346.
- Nghi, T., Lan, N.T., Thai, N.D., Mai, D. and Thanh, D.X. (2007) Tourism carrying capacity assessment for Phong Nha-Ke Bang and Dong Hoi, Quang Binh Province. *VNU Journal of Science, Earth Sciences* 23: 80-87.
- Pappas, N. (2014) Hosting mega events: Londoners' support of the 2012 Olympics. *J. Hosp. Tour. Manag.* 21: 10-17.
- Pearce, D.G. (1989) *Tourism Development*. Longman, Essex, UK.
- Queiroz, R.E., Ventura, M.A., Guerreiro, J.A. and Cunha, R.T.D. (2014) Carrying capacity of hiking trails in Natura 2000 sites: A case study from North Atlantic Islands (Azores, Portugal). *J. Integ. Coast. Zon. Manag.* 14(2): 233-242.
- Ramdas, M. and Badaruddin, M. (2014) Impacts of tourism on environmental attributes, environmental literacy and willingness to pay: A conceptual and theoretical review. *Procedia-Social and Behavioral Sciences* 144: 378- 391.
- Reddy, S. (2007) Mega Tourism in Andaman and Nicobar Islands: Some Concerns. *J. Hum. Ecol.* 21(3): 231-239.
- Ritchie, J.R.B. (1993) Competitiveness in international tourism: A framework for understanding and analysis. World Tourism Education and Research Centre, University of Calgary.
- Ryan, C. (2003). *Recreational tourism: Demand and impacts* (Vol. 11): Channel View Publications. Clevedon.
- Sayan, M.S. and Atik, M.S. (2011) Recreation carrying capacity estimates for protected areas: A study of Termessos National Park. *Ekoloji* 20(78): 66-74.
- Segrado, R., Muñoz, A.P. and Arroyo, L. (2008) Medición de la capacidad de carga turística de Cozumel. *El Periplo Sustentable* 13: 33-61.
- Smith, S.L.J. (1989) *Tourism analysis: A handbook*. Longman Scientific, Harlow.
- Swarbrooke, J. (1999) *Sustainable tourism management*. CAB International, Oxon.
- Syamlal, G.S. (2008) Carrying capacity study of coastal tourism in Kumarakom, Kerala. *Jurnal Ekonomi dan Bisnis* 13(1): 1–15.
- Swarbrooke, J. (1999) *Sustainable tourism management*. Oxford: CABI.
- Tarlow, P. (2014) *Tourism Security*. Oxford, Elsevier.
- Telfer, D.J. and Sharpley, R. (2007) *Tourism and development in the developing world*. Routledge. Oxon.
- Tribe, J., Font, X., Grittis, N., Vickery, R. and Yale, K. (2000) *Environmental management for rural tourism and recreation*. Cassell, London.
- UNEP. (1996) *Guidelines for Integrated Planning and Management of Coastal and Marine Areas in the Wider Caribbean Region*. UNEP Caribbean Environment Programme, Kingston, Jamaica.
- WTO. (1981) *Technical handbook on the collection and presentation of domestic and international tourism statistics*. World Tourism Organization, Madrid.
- WTO. (1990) *Tourism to the year 2000: Qualitative aspects affecting global growth*. Madrid.
- WTO. (2005) *Tourism's Potential as a Sustainable Development Strategy*. World Tourism Organization, Madrid, Spain.
- Zacarias D.A., Williams A.T. and Newton A. (2011) Recreation carrying capacity estimations to support beach management at Praia de Faro, Portugal. *Applied Geography* 31(3): 1075-1081.
- http://www.lakshadweep.nic.in/documents/SnT_Notice/Kavaratti/Kavaratti.pdf