Tourist-Group Consideration in Tourism Carrying Capacity Assessment: a New Approach for the Saint Martin's Island, Bangladesh

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Abstract

Everything has a capacity that it can tolerate or afford, beyond which it cannot serve. Tourism development and management should also be based on the recognition of the limits of a destination. As a result, tourist destinations must have their carrying capacity assessed and managed accordingly with a view to protecting them from getting exploited. In assessing tourism carrying capacity of a particular destination, the formulae given by Cifuentes (1992) and recommended by IUCN (Ceballos-Lascuráin, 1996) are widely used around the world. The formulae recognize the 'necessary distance between two tourists' as a factor that affects tourist satisfaction; and thus, consider it in assessing physical carrying capacity (PCC) of a destination. But Tran Nghi et al. (2007) argue that, the necessary distance between two groups on a route, as well as distance between two people, affects tourist's comfort and should be considered when assessing tourism carrying capacity (TCC). Tran Nghi et al. (2007) tried to make some adjustments to the formulae and used some techniques to consider tourists as in separate groups- not as an individual in a mass. When it is about assessing carrying capacity of a trekking trail or walking route where tourists have to be in a line one behind another, carrying capacity can be calculated for group of tourists using this adjusted formula. But when it is about a beach or a park where tourists are not in queues or lines- rather scattered in the whole area, carrying capacity cannot be calculated based on tourist-group, -rather as a mass. To calculate TCC of such destinations (beach/park) a new technique is proposed and used on the basic formulae of Cifuentes in this study. This new technique is applied in calculating the TCC of the Saint Martin's Island, the only coral island of Bangladesh, as a case study.

Keywords: tourism carrying capacity (TCC), Cifuentes' methodology, tourist-group, Saint Martin's Island

1. Introduction

Natural environment, biologically diverse habitats, and indigenous culture of destination places are the key attractions for the tourists, and often they help create mass tourism. But tourism saturation ultimately causes damage to these key assets for tourism, and finally eventual loss of revenues arising from a collapse in tourism arrivals becomes permanent. To avoid this, tourism carrying capacity is often found to be discussed, thought, calculated, and also implemented in a tourist destination, as every destination has its carrying capacity, beyond which it should not be developed and used for tourism activities.

In fact, the concept of tourism carrying capacity (TCC) gives an idea of the entrance of tourists that can be accepted at a destination while considering the capacities of some components (basically physical, environmental, ecological economic, and socio-cultural,) of the local tourism system.

In 1981, the World Tourism Organization (WTO) proposed a definition of tourism carrying capacity as follow: "The maximum number of people that may visit a tourist destination at the same time, without causing destruction of the physical, economic, socio-cultural environment and an unacceptable decrease in the quality of visitors' satisfaction". Luc Hens (1998) defined the tourism carrying capacity as "The maximum number of people that use tourism site without unacceptable effect on environmental resources while meeting the demand of tourists".

The St. Martin Island, the only coral island of Bangladesh, is suffering from so many physical, social, economic and ecological problems. As a result, for the sustainable tourism development, carrying capacity assessment is often considered one of most effective ways to protect the destination physically, socially, culturally and ecologically- as it covers all of these parameters.

2. Background of the Study

Apart from other attributes, a destination becomes a tourist attraction because of its natural beauty. Tourists visit the place to touch the nature, but nature must not be irritated. The number of tourists is a factor that must hamper the nature and that's why CCA (Carrying Capacity Assessment) is important. CCA limits the tourists in a confined number that the overall natural, social, economic and ecological circumstances can tolerate without minimizing the tourist satisfaction. St. Martin's Island has become one of the most popular tourist destinations in Bangladesh. As a result, the St. Martin Island, the only coral island of Bangladesh, is suffering from so many physical, social, economic and ecological problems.

The appeal of the concept of carrying capacity as a paradigm for addressing and limiting the amount of tourism development and use at a destination has clearly emerged, leading to calls to establish carrying capacities in terms of specific numbers of tourists over a specified time period. Such concerns are deemed appropriate for sustaining local communities and their cultural and environmental context; fears of irretrievably committing resources to specific uses are increasingly important in a world of growing scarcity.

3. Objectives

The main objective of this paper is to assess the tourism carrying capacity of the St. Martin's Island by using the new technique of recognizing the concept of 'tourist-group' and 'distance between groups' based on the basic formula given by Cifuentes (1992).

For that purpose, specific objectives of the study are-

   a. Describing and proposing the new technique to recognize and incorporate the concept of 'tourist-group' and 'distance between groups' in calculating tourism carrying capacity using Cifuentes' formula.

   b. Assessing the carrying capacity of the Saint Martin's Island, Bangladesh (defining the optimum number of people that should be allowed at the St. Martin's Island)

   c. Determining whether the carrying capacity of the beach has been exceeded or it is still in the optimum range

4. Literature Review

The concept of tourism carrying capacity arises from a perception that tourism cannot grow forever in a place without causing irreversible damage to the local system (Coccossis and Mexa, 2004). Carrying capacity analysis is a basic technique used in tourism to determine the upper limits of development and visitor use and optimum exploitation of tourism resources. Within the country, carrying capacities need to be established generally for the planning area and calculated more precisely for each development site at the community planning level (Inskeep, 1991).

From the perspective of spatial distribution, tourism is a highly fragmented activity. It is located in specific environments and destinations, where there is a variety of environmental, cultural, social and physical attractions. The rapid but unplanned development and utilization of these resources create a risk of losing their recovery capacities, destroying the basic functionalities of ecosystem within tourism areas. Various tourism-related factors can be identified to have impact on these resources, among which the number of tourists would be the most important one. The concept of carrying capacity of a tourism site was formed from this perception (Tran Nghi et al., 2007). This concept is important in the tourism planning which aims to sustainable tourism development.

Many writers and academics (e.g. Gartner, 1996; Saveriades, 2000; Wahab & Pigram, 1997) have suggested destinations not be developed for tourism beyond their saturation points or 'innate capacities'. If degradation occurs, then management action is implemented to return the area to within its numeric carrying capacity.

Pereira da Silva (2002) suggests that development objectives are determinant in the calculation of carrying capacity and can help manage the inevitable negative impacts from leisure activities. Research on TCC undertaken by Stephen F McCool and David W Lime (2001) suggest that having reviewed the range of TCC concepts "Our focus should, instead of a numerical approach, be on the deployment of frameworks and strategies that determine which of many plausible futures are desirable, what social, economic and environmental conditions are involved in tourism development, the acceptability of the tradeoffs that would occur, and how people affected can be given voice to articulate concerns and values involved."

Indeed, as highlighted by Pearce et al. (1989 and 1990) the idea of strong sustainability is strictly associated with environmental protection, which would mean to provide a non-declining natural capital stock over time. 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. Carrying capacity has been

described as an appropriate tool for beach management, as it "enables the preservation of the high quality and quantity of coastal resources whilst meeting not only the current needs, but also securing long-term economic and ecological benefits for future generations" (UNEP/PAP, 1997:8). Carrying Capacity was adopted as a management tool because the concept is easy to understand and authorities and tourism operators wanted concrete numbers based on technical analyses to manage, monitor, and make future projections.

Formula given by Cifuentes (1992) is widely used around the world in assessing tourism carrying capacity of tourist destinations of all types. This formula recognizes the necessary distance between tourists for tourist satisfaction and comfort. Tran Nghi et al. (2007) criticize that, the formula does not recognize the importance of necessary distance between groups of tourists, though it recognizes the importance of distance between tourists. As we know, tourists are more likely to be in tourist-groups rather than to be individual-tourist, and when tourists are in groups they need some necessary distance from other groups for their comfort and tourist satisfaction.

Tran Nghi et al. (2007) suggested some techniques to incorporate the distance between groups in calculating tourism carrying capacity of trekking routes or walking ways. But, this same technique cannot be used when the destination is not a trail where tourists are not necessarily in a line or queue one behind another. In case of a destination like beach or park, where tourists are scattered instead of being in a line or queue, this technique proposed by Tran Nghi (2007) is not suitable.

In this study, a new technique has been proposed and used to incorporate the concept of 'distance between groups' in calculating tourism carrying capacity of beach- and park-like destinations based on basic formula given by Cifuentes (1992).

Good beaches are worth billions of tourist dollars and degraded beaches are worth little (Clark, 2005). For the Saint Martin's Island, the concept is particularly more important as it is overloaded with the exceedingly huge number of tourists particularly during the peak season and the local residents who are permanently living there. The island has been declared Ecologically Critical Area by the Government. Particularly, no restriction is there for tourist number to visit the island at time that the island can tolerate as the actual carrying capacity of the island is still unknown. But for sustainable tourism development, tourism carrying capacity is an important tool for managing and controlling the tourists flow to save the nature, tourism industry and society. The study attempts to assess the carrying capacity of the Saint Martin's Island in terms of its physical, social, economic and ecological contexts for sustainable tourism development using the modified formula.

5. Methodology

Physical, real, and effective carrying capacities will be assessed by using Cifuentes' methodology (Cifuentes, 1992) which was suggested by the IUCN (Ceballos-Lascuráin, 1996). The logic of the method is based on the site specific factors which reduce the level and quality of visitation and which are considered as the limitations of the area.

5.1 Physical carrying capacity (PCC)

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

$$PCC = A \times V/a \times Rf \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where: *A:* available area for use (m²); *V/a:* required space per tourist (one tourist / required m²); *Rf:* Rotation factor (number of visits per day).

A is determined by particular conditions of the considered area. For beach, the available area may be the length and width of the beach that are allotted for tourism activities. The tourist density or the area required per tourist *V/a* is the area needed for a tourist who can undertake activities comfortably.

Rotation factor is the number of permissible visits over a specified time (usually calculated by daily open hours) and expressed by:

$$Rf = \text{Open period / average time of visit} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

5.2 Real Carrying Capacity (RCC)

Definition: the maximum permissible number of visits to a site, once the corrective (i.e. reductive) factors derived from the particular characteristics of the site have been applied to the PCC and expressed by the following general formula where Cf is a corrective factor:

$$RCC = PCC \times \frac{100-cf1}{100} \times \frac{100-cf2}{100} \times \dots \times \frac{100-cfn}{100} \dots\dots\dots\dots\dots\dots\dots (3)$$

Where: *Cf* (corrective factors or limiting factors) are factors which have negative impact on tourism activities

and assessed by limiting threshold which used for identifying impact level of a factor. Where corrective factors can be determined by:

$$Cf = \frac{M1}{Mt}$$ ……………………………………………………………………. (4)

*Where: M*1: limiting magnitude of variable; *Mt:* total magnitude of variable.

These factors are translated into quantitative or semi quantitative values which measure the adaptability of environmental, socio-economic subsystem and tourists' demand.

5.3 Effective carrying capacity (ECC)

Definition: the maximum number of visits that a site can sustain, considering the management capacity (MC)" and formulated as:

ECC = RCC × MC………………………………………………………………….. (5)

6. Discussion about the New Technique

The new technique is all about Physical Carrying Capacity (PCC) and will be used for determining physical area needed by each group. For that purpose we have to assume the number of tourists in each group in a pattern, so that the group can take a shape of a square or a rectangle comprising with the tourist number such as 4, 9, 12 etc. The purpose of making a square or rectangle is to make it easy to visualize the area required by each group and thus have space surrounding each group to determine the distance between groups.
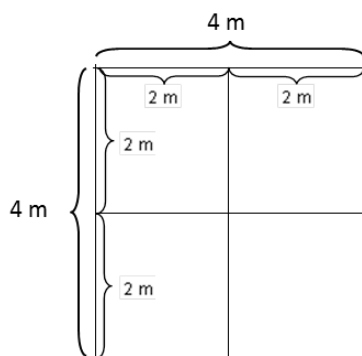

Figure 1. Area covered by a group of 4 tourists

For example, if each tourist requires 4m^2 (2m×2m), total area required by a group of 4 tourist will be 16m^2 (4m^2 ×4). If we set the group as a square (figure 1), we can see, as a group it requires 4 meters in its length and 4 meters in its width. Again we can calculate the required area by the group by multiplying its length and width (4m×4m), and the result will be the same, which is 16m^2. This 16m^2 is required for having the necessary distance between tourists within the group for participation in tourism activities comfortably and for tourist satisfaction. But, distance between groups is also important for tourist comfort and satisfaction, as a tourist-group may not like to have another unknown tourist-group very close to them on the beach for their privacy or for some other reasons.
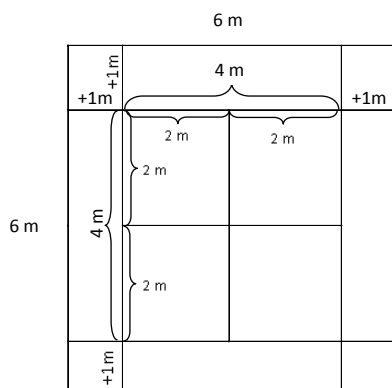

Figure 2. Distance required by a group of 4 tourists

So, if they require a distance of 2m from other groups around their group, then a space of 1m should be kept in

all 4-sides of each group (figure 2).As a result, each and every group will have a distance of 2m from each other(1m of one group + 1m of another group), as shown in figure 3.
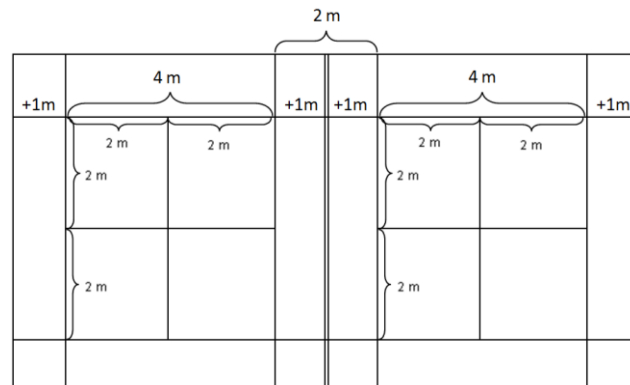

Figure 3. Distance between two groups

As shown in figure 2, adding 1 meter in all the four-sides, for the required distance between groups, its length will be 6m (4m+1m+1m) and width will be also 6m (4m+1m+1m).

So, the ultimate area required by each group, taking into consideration the necessary distance between groups, will be: 6m×6m = 36m^2.

7. Study Area

Coastal and Wetlands Biodiversity Management Project (CWBMP), a UNDP-GEF funded project implemented by the Department of Environment (DoE) under the Ministry of Environment and Forests, Government of Bangladesh, has developed a proposal for zoning of St. Martin's Island. The term "zoning" means dividing the Island (Ecologically Critical Area) into logical units for management and conservation purposes, with the aim of defining and limiting uses and acceptable development in each zone.
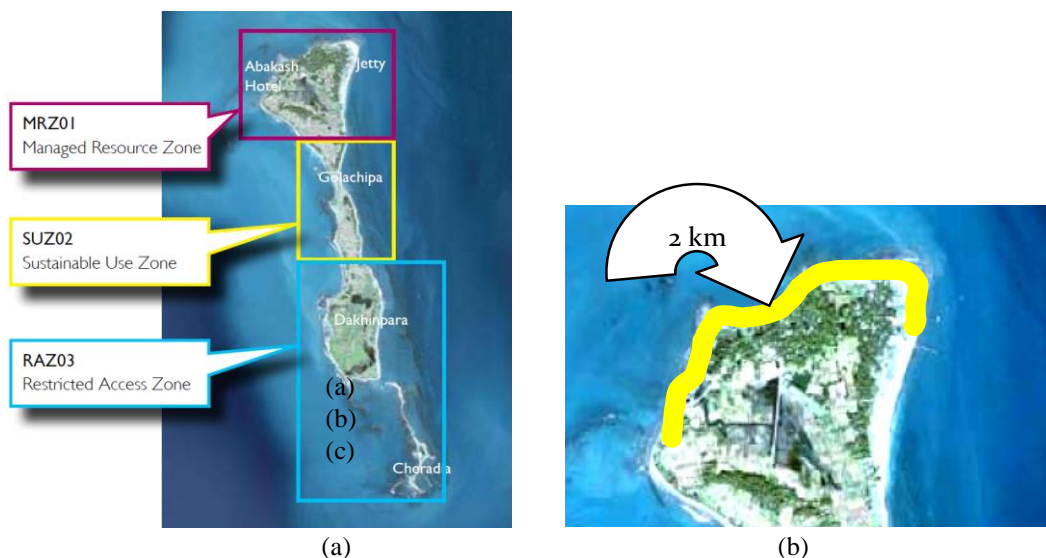

Figure 4: (a) three zones of St. Martin's Island (Source: CWBMP); (b) yellow line represents the coastal length allotted for tourism activities (Source: Authors)

Of these three zones, only the 'Managed Resource Zone' should be allowed for tourism. Rest of the other parts should be restricted for tourism and protected from local community. On this basis, the tourism is to be concentrated only on the 'MRZ O1' and thus the carrying capacity of this zone should be calculated. The main tourism activity in the Saint Martin's Island is beach tour, which is swimming and walking by the side of the beach. Thus the length of the coastline is considered for the physical carrying capacity.

8. Tourism Carrying Capacity Assessment for St. Martin's Island

8.1 Physical Carrying Capacity (PCC)

To calculate Physical Carrying Capacity (*PCC),* the following assumed physical parameters should be

considered:

- Total area of beach allocated for tourists: 40000m ²from North & North-West coastline (2000m length with 20m width on average).
- Average area required per tourist: 4m^2 (2m×2m).
- Average number of tourists in one group: 9 tourists.
- Distance between groups from each other: 2m.
- Average time for using the beach by tourists: 3 hours
- Beach using period: 6 hours (high tide in daylight from 10:00 to 16:00). Of these 6 hours, visitors are assumed to remain there for 3 hours for the purpose of having two visitor periods.
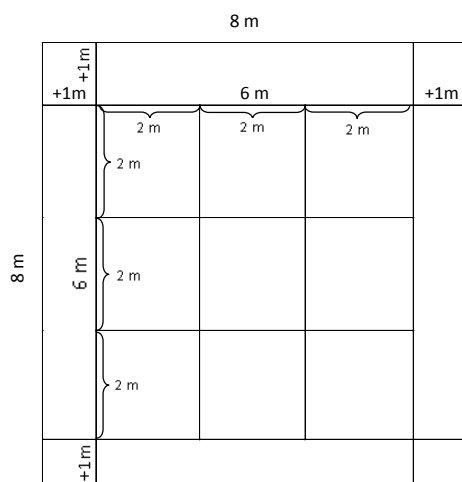

Figure 5. Area required by each group

Area per Group: Each group of 9 tourists, as shown in figure 5, requires 8m in its length and 8m in its width (including the space required for necessary distance between groups).

So, area required per group: $8 \times 8 = 64$ m ²

Let x be the maximum number of groups to be allowed to the beach. So, the number of groups can be expressed by the following equation:

$$x \times 64 = 40,000$$
$$\Rightarrow x = 625 \text{ groups}$$

Beach using period is 6 hours/day (high tide in daylight); each tourist takes about 3 hours. Thus, the number of visits per day is 2 (Rf= 6/3). Therefore, the maximum number of visits per day is:

$$PCC = (625) \times (9) \times (2 \text{ daily period}) = 11,250 \text{ tourists/day}$$

Thus, the maximum number of tourists that Saint Martin's Island physically can serve is about *11,250 tourists per day.*

### 8.2 Real Carrying Capacity (RCC)

Corrective Factors:

+ *Temporary closer (Cf1)*: The Island receives tourists only *from September to March for a period of 7 months* as ships are operated only during this period in the year. Access to the Island is quite limited during the rainy season due to very rough seas and this is an important consideration for management planning. So, from April to August, those *5 months* should be considered as limiting factor, restricting tourists during that time period.
So, $Cf1 = 5/12 = 42\%$.

+ *Tourists Safety factor (Cf2):* Around 10% of the length in the North-Western side of the given coastal line is

assessed to have potential risk for tourists' safety as it is full of broken coral debris and foraminifera, and are overlaid on nearly all sides by stony and sharp corals and boulders (see figure 6-a).
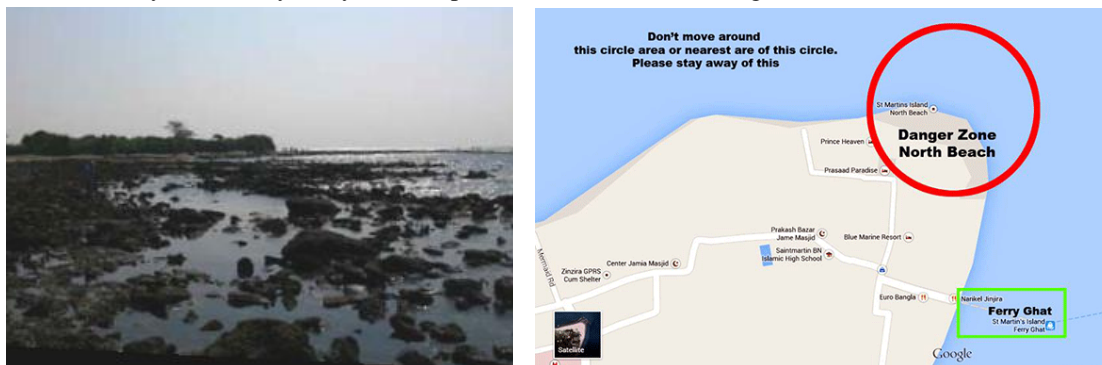
6(a)   6 (b)

Figure 6. (a) North-Western Beach, (b) the North Beach

Again, accidents occur at the North Beach (see figure 6-b). The area is triangular, so the water pressure is of insane amount here causing 'rip current'. Tourists have been washed off by rip current in the recent past. It covers an area of around 200 meters or 20% of the beach length.

Therefore, *Cf2*= (10 + 20) %=30%

+ *Fishing area (Cf3):* Local people normally catch small fishes from near-shore by using nets that they operate from the beach. Thus, at least 10% of the beach should be kept free from tourists for the local fishermen.

Cf3=10%

+ *Bad Weather/ Ship Cancellation (Cf4):* Ships are operated between Teknaf and Saint Martin's Island from September to March for a period of 7 months. But, particularly in the months of September and March, ships are cancelled due to bad weather and signal for on an average 10 days of each month. Hence, those days of September and March should be taken as limiting factor. Thus-

M4: 10+10= 20 days; and Mt: 30$\times$7= 210 days; thus, *Cf4*= 20/210 = 9.5%

+ *Accommodation limiting factor (Cf5):* A questionnaire was used for accommodation (hotel, guest house, and restaurant) quality assessment. Respondents chosen for the survey were students and tourists, According to the assessment of tourists and staff (Figure 7):
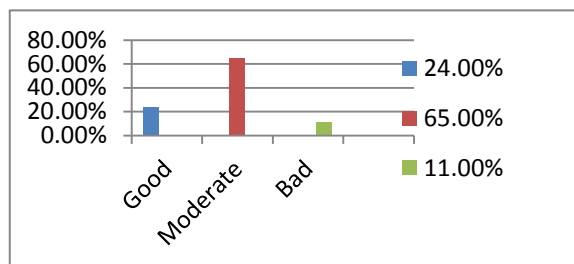
Cf5=11%

Figure 7. Infrastructure quality assessments

+ *Transportation limiting factor (Cf6):* Total 5 ships operate between Teknaf and Saint Martin's Island from September to March with the seating capacity of 445 passengers each. Many other tourists choose trawler, fishing boat and speed boat for the same purpose. On average 5000 tourists visit the island daily from November to February (the Daily Star: December 1, 2013). The number of tourists visiting the island *each day* during the tourist season is estimated as shown in the following table.

Table 1. Number of tourists visiting St. Martin's Island per day in peak season

Sep	Oct	Nov	Dec	Jan	Feb	March
1000 tourists	2000 tourists	5000 tourists				1000 tourists

It was found from the field survey that ships are overloaded at least by 33% of their seating capacity during peak season from November to February. This is a threat for tourists' safety and thus should be considered as a limiting factor.

So, the number of overloaded tourists in ships= (445×5×0.33) = 734 tourists every day from November to February. But in September, October and March, ships are not overloaded. So, we have to find the weighted average number of overloaded tourists.
Total number of overloaded tourists from November to February (for 4 months or 120 days) = (734×4×30) = 88080 tourists.

Average number of overloaded tourists for 7 months or 210 days in peak season (from September to March) = 88080÷210=419 everyday.

Total number of tourists for 7 months of peak season (from Table 1) = (1000×30) + (2000×30) + (5000×30×4) + (1000×30) = 720,000 tourists.

Average number of tourists every day during peak season (from September to March) = (720,000 ÷210) = 3428 everyday.

So, *M6*: 419 tourists; Mt: 3428 tourists; thus *Cf6*= 419/3428 = 12%

From the above assessment, **RCC** of the Saint Martin's Island can be computed as:

$$\text{RCC} = PCC \times \frac{100 - cf1}{100} \times \frac{100 - cf2}{100} \times ... \times \frac{100 - cfn}{100}$$

$$RCC = 11250 \times 0.58 \times 0.7 \times 0.9 \times 0.905 \times 0.89 \times 0.88$$

$$= 2913\ (tourists/day)$$

So, the Real Carrying Capacity (RCC) of the Saint Martin's Island is **2913 tourists/day.**

8.3 Effective Carrying Capacity (ECC)
Management capacity (MC)" was estimated from the perception of the tourists, because they are the beneficiaries or sufferers and observe the management capacity directly and closely.
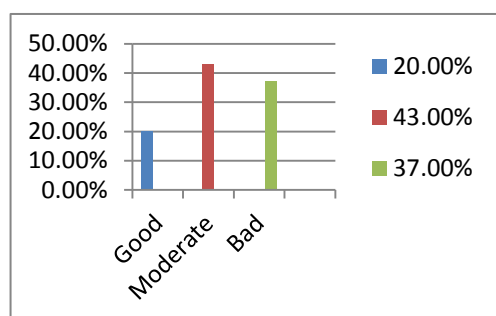

Figure 8. Management capacity assessments

The capacity of jetty, Water and Energy supply, condition of waiting house, Management people's capability in Jetty, Waste management condition were the consideration for management capacity (MC) and the figure was found from weighted average of these factors (see figure 8).

So, MC = (100 − Bad) % = (100 − 37) % = 63%

ECC = RCC ×MC
    = 2913 ×0.63

= 1835 tourists/Day

So, the optimum number of tourists to be allowed to the St. Martin's Island is **about 1835 tourists per day.**

But according to the Daily Star (December 1, 2013), on average 5000 tourists, visit the island daily from November to February, and on some weekends visitor figures even cross 8000 people. This indicates that, the real situation is not favorable for our only coral colony, as the number of visiting tourists is a threat for the entire island. Proper steps should be taken by the authority concern to delimit the number of visitors in order to protect the nation's very unique asset; if it is lost the next generation will never be able to feel the beauty of such a heaven away from heaven.

9. Conclusion

Concept of Tourism Carrying Capacity Assessment arises from the notion that, as overcrowding by the tourists is harmful and can destroy the natural, social and ecological system of a destination, acceptable level of tourist density must be ensured. Thus, TCCA is estimated and applied nearly in every remarkable destination in the world, particularly in the developed countries. For the Saint Martin Island, assessment and implementation of TCC is particularly important. It is the only coral island and thus one of most attractive tourist destinations of Bangladesh and a huge number of tourists visit the island during the peak tourism season. The island is very small in size, but local population is huge, let alone the tourists. Government of Bangladesh has declared the island as an Ecologically Critical Area, to draw national and international attention to the island in an attempt to protect its unique ecosystem. In this circumstance, to protect both the island and also the tourism industry, a sustainable balance is needed. Carrying capacity assessment can serve this purpose, but no significant work has been done in this regard. This work is an attempt to initiate the process of assessing the TCC more scientifically for the Saint Martin's Island for sustainable tourism development.

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