

Chapter- 4

Tourism Climate Index for Assessing the Favourable Period for Tourism Recreation Activities with Application of Geospatial Techniques

4.1 Significance of TCI Model in Coastal Tourism

The land and sea transitional coastal areas are influenced by maritime climate throughout the year with seasonal and somehow local control on its parametric variability. On the basis of the climatic comfort and plenty of natural resources people are gathered on the coastal areas. Furthermore, natural beauties attract people on the coastal areas. Therefore, the favorable weather condition has played an important role in the intensification of the coastal tourism and it is important to evaluate interrelationship between the climatic conditions and coastal tourism. Also, it is necessary to understand the favorable period of visiting in a particular coastal area for refreshment and recreation of the people or tourists. The weather condition is ever changing in the coastal environment that influences on the tourists flow through making their decision about preferences of holiday destination sites. [Mieczkowski \(1985\)](#) first analyze the relationship between the climate and tourism through introducing the Tourism Climate Index (TCI). There are some benefits of TCI indexing as it can promote international tourism and provide information about the better use of charming weather condition of a region. However, the changing nature of global and regional climate and weather condition effects on the tourism industry and reducing the attractive potentiality of the tourist as well as the destination sites ([Küle et al., 2013](#)). As a result, the regional, country level and global economy may affected from the climate change and reducing tourism. Furthermore, the increasing temperature and depleting groundwater level caused for water scarcity in the coastal areas with other part of the territory. The high temperature and rainfall also develops many diseases like malaria, dengue and that is dangerous for human health ([McMichael et al., 2003](#)). So, it is important to analysis the individual effects of the climatic parameter on the tourists by evaluating TCI in this study.

4.2 Effect of Climatic Parameter on Human Health of Tourists

Climate is not only affecting the wellbeing of the tourists but also influences on tourists' entertainment like outdoor activities, relaxation and their happiness. The different climatic parameters that affect the human health are temperature, precipitation, humidity, and wind speed. Temperature and humidity are the main factor that effects on the coastal environment. The scorching heat and the excessive humidity are very uncomfortable for the tourist. Sometime, the excessive sunshinemay stimulate human blood circulation and that may create serious illness. So, the ideal climatic condition should be satisfying the tourist's physical and mental health. The dry and stormy wind in summer is very harmful for the tourists to employ their outdoor activities.Excessive rainfall can also create problem for

tourists' activities. Therefore, in our natural environment climate is the most effective and influential parameter for coastal tourism.

4.3 Assessment Method of theTCIIndex

The assessment of favorable climatic condition for tourist flow into the destinations there has needed to assess the parametric climatic data. Therefore, the climatic data of tourism destinations has been collected for 35 years (1979 – 2014). The meteorological data of minimum and maximum temperature, precipitation, sunshine hours, relative humidity (mean of relative humidity and mean of minimum of relative humidity) and wind speed are collected from NOAA-based selective stations at the coordinate of 21.69 N and 88.12 E for the sites of Bakkhali, Frejerganj and Benubon, 21.69 N and 88.43 E coordinated for Henry’s Island, 21.69 N and 87.81 E for Gangasagar, Nayachar and Mandirtala, and 21.6999 N and 87.52 E coordinated for Mandarmani, Dadanpatrabar and Rasulpur tourism areas [Note: The climatic data for the destinations of Dakshinpurosuttampur, Boatkhali and Beguakhali are not available for analysis of TCI values].The estimation of TCI depends on the analysis of the aforementioned meteorological variables of the tourism destinations. The TCI is estimated based on the [equation 4.1 \(Mieczkowski, 1985\)](#).

$$TCI = 4Cld + Cla + 2R + 2S + W \dots\dots\dots(Eq. 4.1)$$

However, the individual variables are weighted according to their relative importance for tourist wellbeing. Where, Cld =day time comfort index and composed of maximum temperature and minimum daily relative humidity; Cla=daily comfort index and composed of minimum temperature and mean of minimum of relative humidity, P= Precipitation in mm, S= daily sunshine hours and W= Wind speed in km/hour. Therefore, the day-time comfort index carries 40 percent weight in the TCI equation, the daily comfort index carries only 10 percent weight, precipitation and sunshine hours assigned a weight of 20 percent in each, and wind speed weighted as 10 percent and develops the above formula. Furthermore, to the equation 4.1 is simplified through numerical transformations of the above climatic parameters and simplified into a 5-scaled optimal rating for every variable. Therefore, the equation 4.1 can be rewrite as the equation 4.2.

$$TCI = 2\{(4 \times 5) + 5 + (2 \times 5) + 5\} = 100 \dots\dots\dots(Eq. 4.2)$$

Depending on the equation 4.2, the entire meteorological parameters of 35 years are analyzed ([Annexure 68, 71, 74 and 77](#)) and determined the monthly climatic comfort condition of the each destination site ([Table 4.4](#)). Therefore, the parameter-based rating systems are also shown in the ([Table 4.1, 4.2 and 4.3](#)). Finally, the monthly favorable period

for tourist's recreation activities in the coastal region is layout with the help of GIS software (Arc GIS).The indicator shares the 20 percent weight in the TCI formula. In TCI equation the precipitation rate is obtained from this table (Table 4.1). Therefore, in this rating system when the precipitation amount is increasing the rating system will be decreases. This rating system is adopted from Mieczkowski, 1985.

Table 4.1: Precipitation variable rating system for Tourism Climate Index (TCI).

Precipitation Variable	Mean Monthly Precipitation
5.0	0.0-14.9mm
4.5	15.0-29.9mm
4.0	30.0-44.9mm
3.5	45.0-59.9mm
3.0	60.0-74.9mm
2.5	75.0-89.9mm
2.0	90.0-104.9mm
1.5	105.0-119.9mm
1.0	120.0-134.9mm
0.5	135.0-149.9mm
0.0	150.0mm or more

In the indicator shares the 20 percent weight in the TCI formula. The highest value indicates that the maximum Sunshine hours in a day. The sunshine hour’s variables are obtained from the table (Table 4.2).

Table 4.2: Sunshine variable for Tourism Climate Index (TCI).

Rates	Mean Monthly Hours of Sunshine Per Day
5.0	10 hrs or more
4.5	9 hrs -9hrs 59 min
4.0	8hrs-8hrs 59min
3.5	7hrs-7hrs 59min
3.0	6hrs-6hrs 59min
2.5	5hrs-5hrs 59 min
2.0	4hrs-4hrs 59 min
1.5	3 hrs-3hrs 59 min
1.0	2hrs-2hrs 59 min
0.5	1hrs-1 hrs 59 min
0.0	Less than 1 hr

The indicator shares the 10 percent weight in the TCI formula. Wind is an intricate indicator in assessment of tourist comfort in the study area. Therefore, a wind rating system is adopted fromMieczkowski, 1985 and a normal wind speed system has considered where thelowest mean monthly wind speed has the highest rate from the (Table 4.3).

Table 4.3: Wind speed variable for Tourism Climate Index (TCI).

Wind Speed(km/h)	Normal System
<2.88	5.0
2.88-5.75	4.5
5.76-9.03	4.0
9.04-12.23	3.5
12.24-19.79	3.0
19.80-24.29	2.5
24.30-28.79	2.0
28.80-38.52	1.0
>38.52	0

Finally calculating the above TCI formula, the numeric value of the indexing is placed between the ranges of the values and find out the climatic comfort for each tourist destination sites from the following table (Table 4.4).

Table 4.4: Tourism climate index numerical values and descriptive category of climatic comfort.

Numerical Values of Indices	Descriptive Category
90-100	Ideal
80-89	Excellent
70-79	Very Good
60-69	Good
50-59	Acceptable
40-49	Marginal
30-39	Unfavourable
20-29	Very Unfavourable
10-19	Extremely Unfavourable
0-9	Impossible

However, after calculating the TCI formula for the each month of the tourist's destination sites (Table 4.5) of the study area a list of climatic comfort (Table 4.6) for each destination sites is compose and finally describe the each month on the basis of climatic comfort variability of each month on the destination sites.

Table 4.5: TCI value for monthly variation (30days) in the coastal destination sites.

Tourism Destinations	January	February	March	April	May	June	July	August	September	October	November	December
Mandarmani	81.83	70.56	54.72	48.66	43.80	39.52	49.41	54.8	50.22	54.80	77.13	83.83
Dadanpatrabar	81.83	70.56	54.72	48.66	43.80	39.52	49.41	54.8	50.22	54.80	77.13	83.83
Rasulpur	81.83	70.56	54.72	48.66	43.80	39.52	49.41	54.8	50.22	54.80	77.13	83.83
Nayachar	78.79	80.44	54.87	52.89	49.19	42.01	62.46	64.95	62.29	60.43	82.21	81.64

Mandirtala	78.79	80.44	54.87	52.89	49.19	42.01	62.46	64.95	62.29	60.43	82.21	81.64
Gangasagar	78.79	80.44	54.87	52.89	49.19	42.01	62.46	64.95	62.29	60.43	82.21	81.64
Benubon	71.77	77.08	86.33	72.36	62.80	60.25	71.86	72.61	70.75	75.30	78.69	74.5
Bakkhali	71.77	77.08	86.33	72.36	62.80	60.25	71.86	72.61	70.75	75.30	78.69	74.5
Henry's Island	74.36	78.63	83.16	64.16	53.30	53.77	74.97	73.55	71.5	75.5	80.16	76.66
Frejerganj	71.77	77.08	86.33	72.36	62.80	60.25	71.86	72.61	70.75	75.30	78.69	74.5

Table 4.6: Category of climatic condition of the destination sites.

Month	Coastal Destination sites	Category of Climatic Conditions
January	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery, Nayachar Island, Mandirtala and Gangasagar.	Excellent
	Benubon, Henry's Island, Bakkhali, Frejerganj, Nayachar Island, Mandirtala, Gangasagar	Very good
February	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery, Benubon, Bakkhali and Frejerganj	Excellent
	Benubon, Bakkhali, Frejerganj, Henry's Island	Very good
March	Nayachar Island, Mandirtala, Gangasagar	Excellent
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery,	Good
	Benubon, Frejerganj, Bakkhali	Acceptable
April	Benubon, Frejerganj, Bakkhali	Very good
	Henry's Island	Good
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery, Nayachar Island	Acceptable
May	Benubon, Frejerganj, Bakkhali	Good
	Nayachar Island, Mandirtala, Gangasagar, Henry's Island	Acceptable
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery	Marginal
June	Benubon, Frejerganj, Bakkhali	Acceptable
	Nayachar Island, Mandirtala, Gangasagar, Henry's Island	Marginal
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery	Unfavorable
July	Benubon, Frejerganj, Bakkhali, Henry's Island	Very good
	Nayachar Island, Mandirtala, Gangasagar,	Good
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery	Marginal
August	Benubon, Frejerganj, Bakkhali, Henry's Island	Very good
	Nayachar Island, Mandirtala, Gangasagar,	Good
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery	Acceptable
September	Benubon, Frejerganj, Bakkhali, Henry's Island	Very good
	Nayachar Island, Mandirtala, Gangasagar,	Good
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery	Acceptable
October	Benubon, Frejerganj, Bakkhali, Henry's Island	Very good
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery, Nayachar Island, Mandirtala,	Acceptable

	Gangasagar,	
November	Nayachar Island, Mandirtala, Gangasagar, Benubon, Frejerganj, Bakkhali, Henry's Island	Excellent
	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery	Very good
December	Mandarmani, Dadanpatrabar and its periphery, Rasulpur mouth and its periphery, Nayachar Island, Mandirtala, Gangasagar, Henry's Island	Excellent
	Benubon, Frejerganj, Bakkhali	Very good

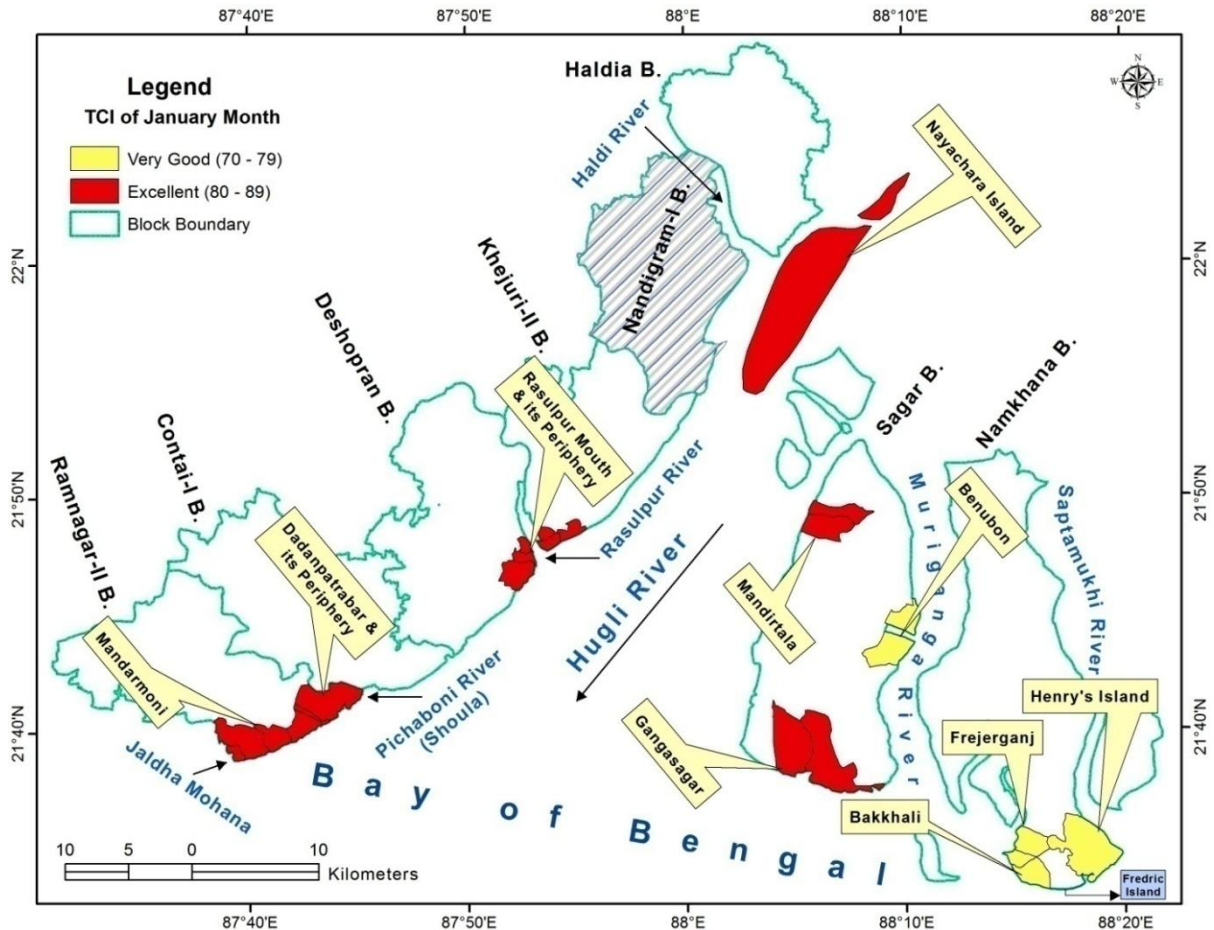


Fig.4.1: TCI map for the month of January in the ecotourism destination sites.

4.4 Analysis the TCI Value of Each Month in the Coastal Destinations

4.4.1 TCI Value for the Month of January

The month-wise TCI results of the month of January reveals (Fig.4.1; Table 4.5) that the sites of Mandarmani (81.83), Dadanpatrabar (81.83), Rasulpur (81.83), Nayachar Island (78.79), Mandirtala (78.79) and Gangasagar (78.79) are the most favorable destination for the tourists' recreational activities for the very comfortable climatic conditions. However, the TCI values for the remaining tourism destinations of Benubon (71.77), Bakkhali (71.77), Henry's Island (74.36) and Frejerganj (71.77) provides the very good climatic conditions for supporting the tourists' recreational activities.

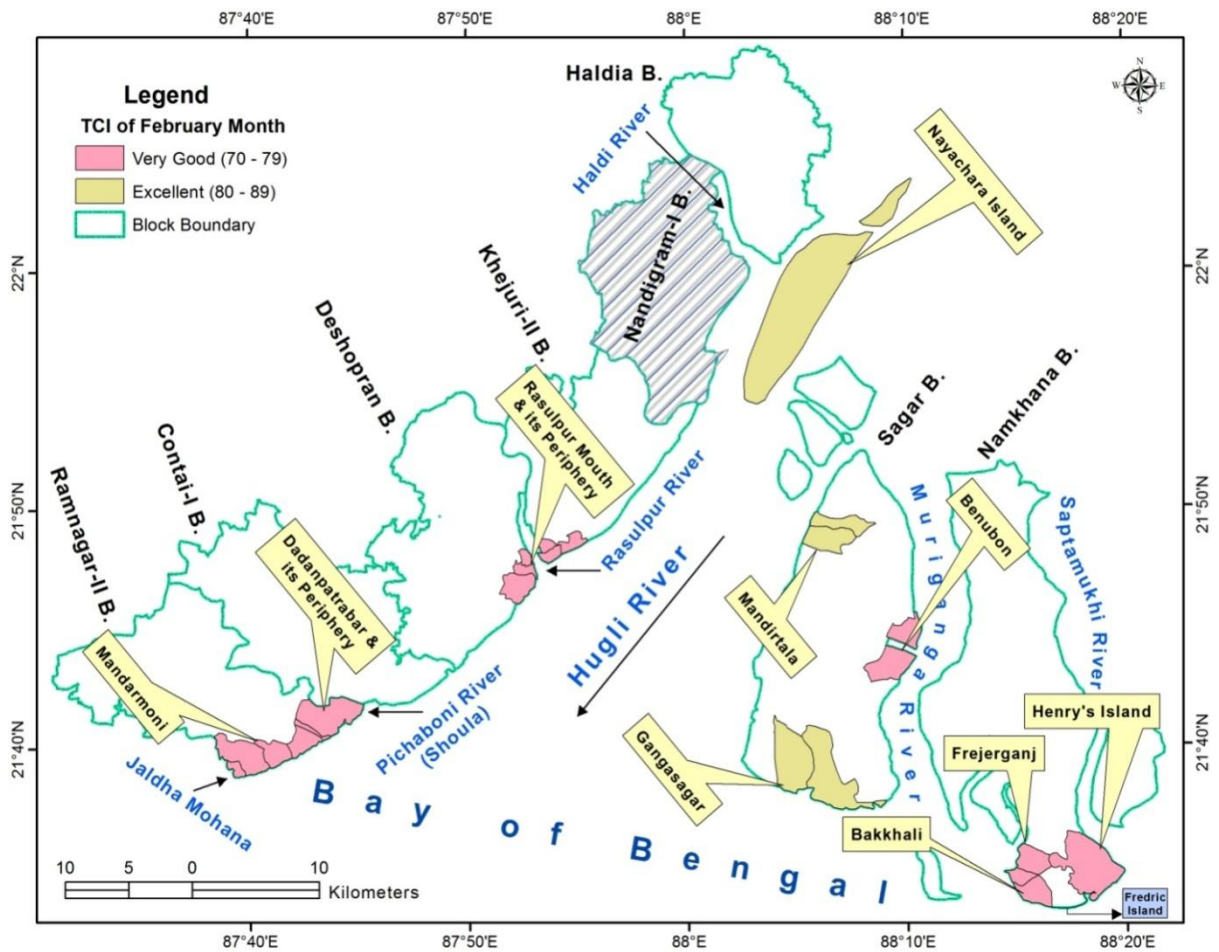


Fig.4.2: TCI map for the month of February in the ecotourism destination sites.

4.4.2 TCI Value for the Month of February

Similarly, the TCI of February shows that (Fig. 4.2; Table 4.5) the destinations of Nayachar Island (80.44), Mandirtala (80.44) and Gangasagar (80.44) have the excellent climatic condition and provide the most favorable destinations in the study area. However, the remaining tourists’ destinations of Mandarmani (70.56), Dadanpatrabar (70.56), Rasulpur (70.56), Benubon (77.08), Bakkhali (77.08), Henry’s Island (78.63) and Frejerganj (77.08) gets the very good climatic conditions for the tourists’ recreational activities.

4.4.3 TCI Value for the Month of March

In the month of March, the temperature is become hot and the climatic condition is little bit unfavorable for the tourists. After assess the TCI value of the month of March it shows that (Fig. 4.3; Table 4.5) the destinations of Benubon (86.33), Bakkhali (86.33), Henry’s Island (83.16) and Frejerganj (86.33) get the excellent climatic conditions for tourist’s arrival and recreation activities. The destinations of Nayachar Island (54.87),

Mandirtala (54.87) and Gangasagar (54.87) get the good climatic conditions. The remaining coastal destinations of Mandarmani (54.72), Dadanpatrabar (54.72) and Rasulpur (54.72) are favourable for tourism activities due to the acceptable climatic condition.

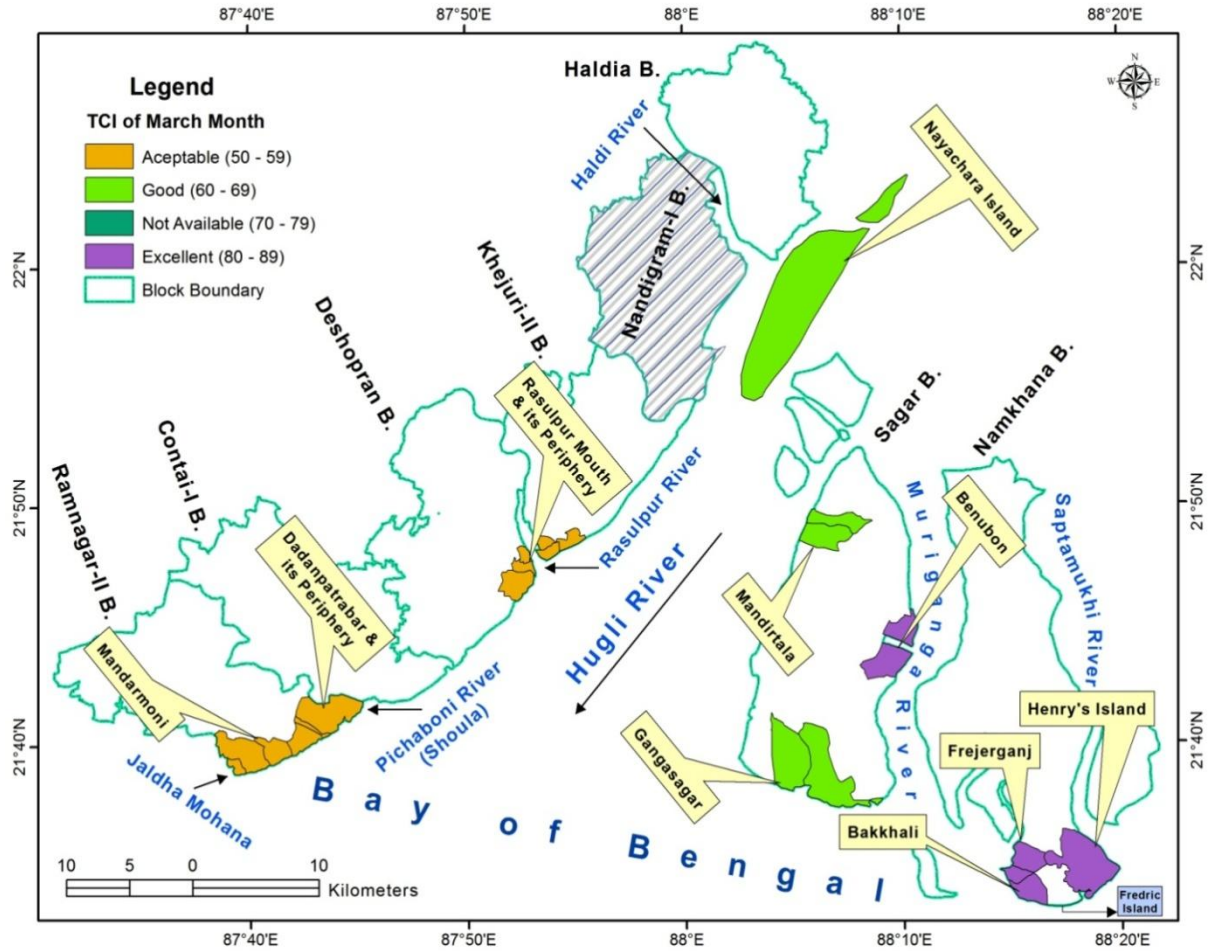


Fig.4.3: TCI map for the month of March in the ecotourism destination sites.

4.4.4 TCI Value for the Month of April

Considering all the climatic parameters the TCI is assessed and the result of the month of April shows that (Fig. 4.4; Table. 4.5) the destinations of Benubon (72.36), Bakkhali (72.36) and Frejerganj (72.36) have the very good climatic condition. However, Henry’s Island (64.16) shows a good climatic condition. The Remaining tourism destinations of Mandarmani (48.66), Dadanpatrabar (48.66), Rasulpur (48.66), Nayachar Island (52.89), Mandirtala (52.89) and Gangasagar (52.89) have the acceptable condition for arriving the tourists due to the scorching heat and the high humidity that may uncomfortable for the tourists.

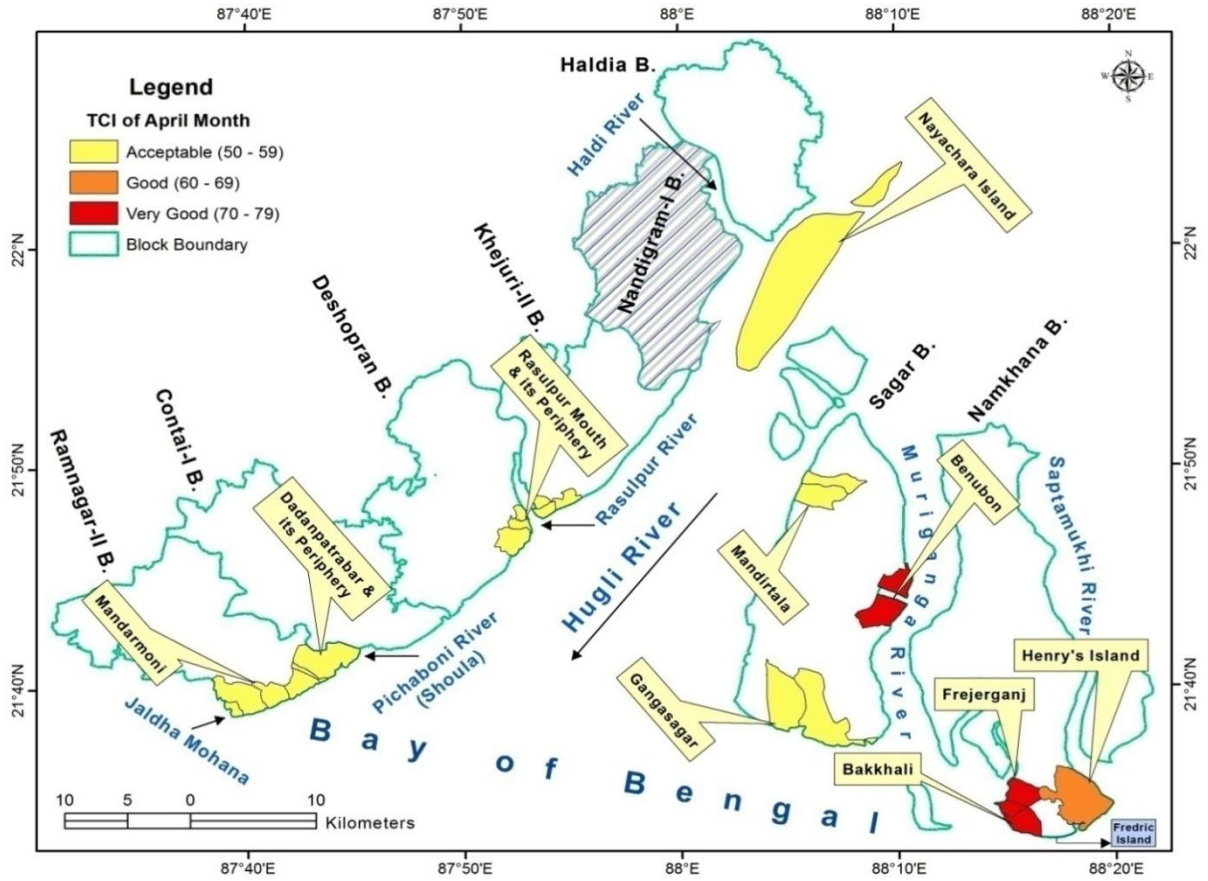


Fig.4.4: TCI map for the month of April in the ecotourism destination sites.

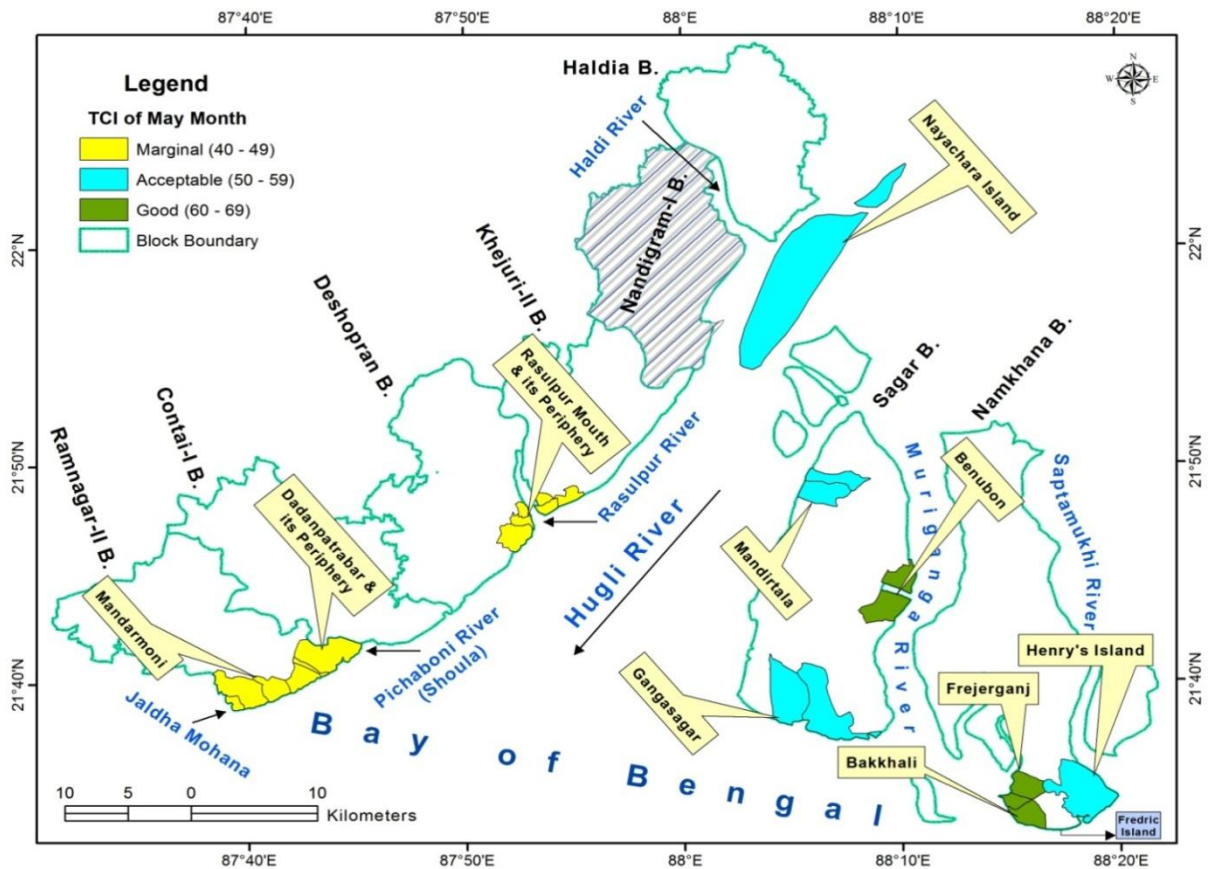


Fig.4.5: TCI map for the month of May in the ecotourism destination sites.

4.4.5 TCI value for the month of May

In the month of May (Fig.4.5; Table.4.5) after analysis the TCI it shows that in Benubon (62.80), Bakkhali (62.80) and Frejerganj (62.80) the climatic condition is good. However, in the Nayachar Island (49.19), Mandirtala (49.19), Gangasagar (49.19) and Henry’s Island (53.30) have the acceptable climatic condition. The remaining coastal destinations of Mandarmani (43.80), Dadanpatrabar (43.80), Rasulpur (43.80) have the marginal climatic condition due to the hot wind during this month that is unfavorable for the tourists’ activities.

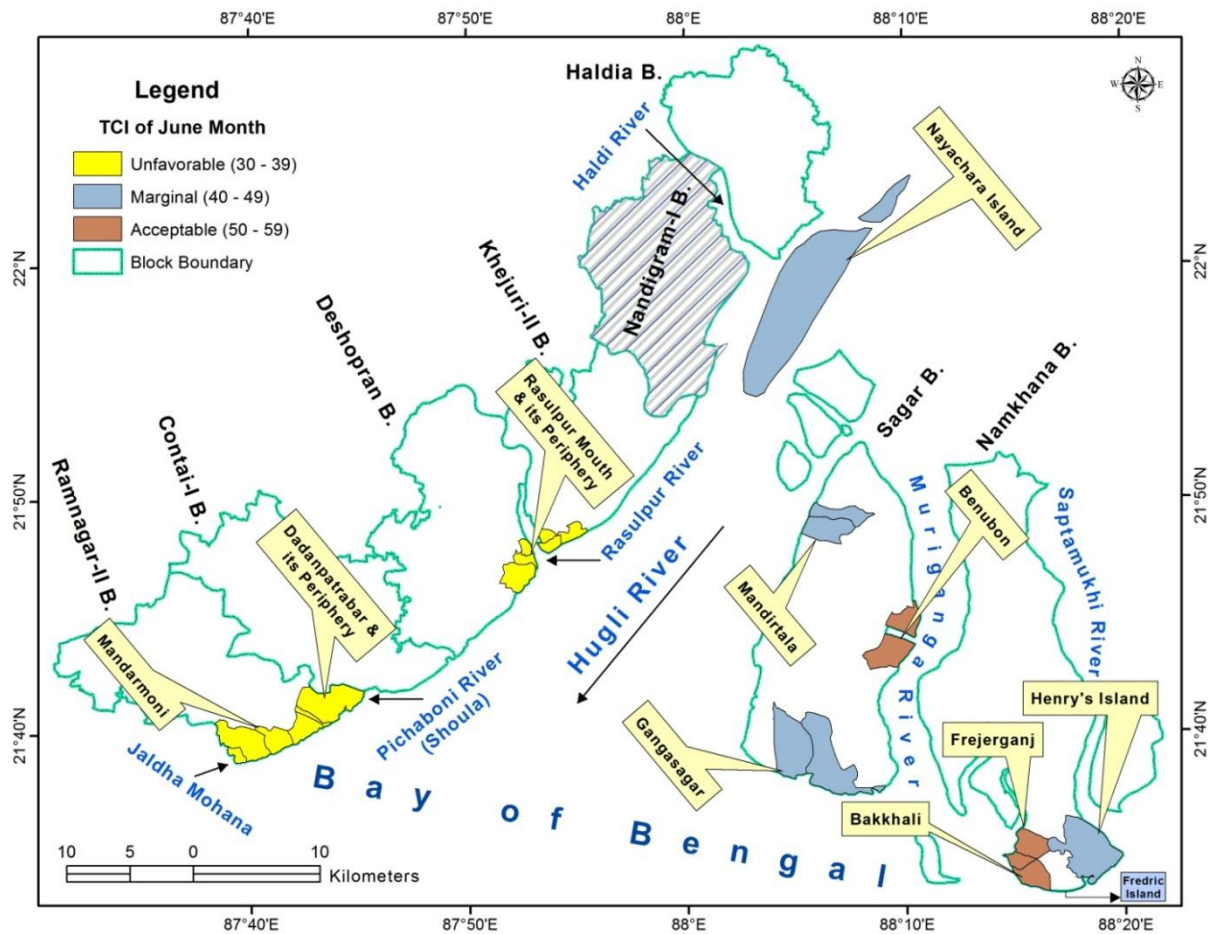


Fig.4.6: TCI map for the month of June in the ecotourism destination sites.

4.4.6 TCI Value for the Month of June

In the month of June the monsoonal rainy season starts. The TCI of the month of June shows that (Fig.4.6; Table 4.5) the Benubon (60.25), Bakkhali (60.25) and Frejerganj (60.25) have the acceptable climatic conditions for the tourists. The Nayachar Island (42.01), Mandirtala (42.01), Gangasagar (42.01) and Henry’s Island (53.77) have the acceptable climatic conditions for the tourists. The Mandarmani (39.52), Dadanpatrabar (39.52) and Rasulpur (39.52) are the unfavorable climatic conditions for the tourists.

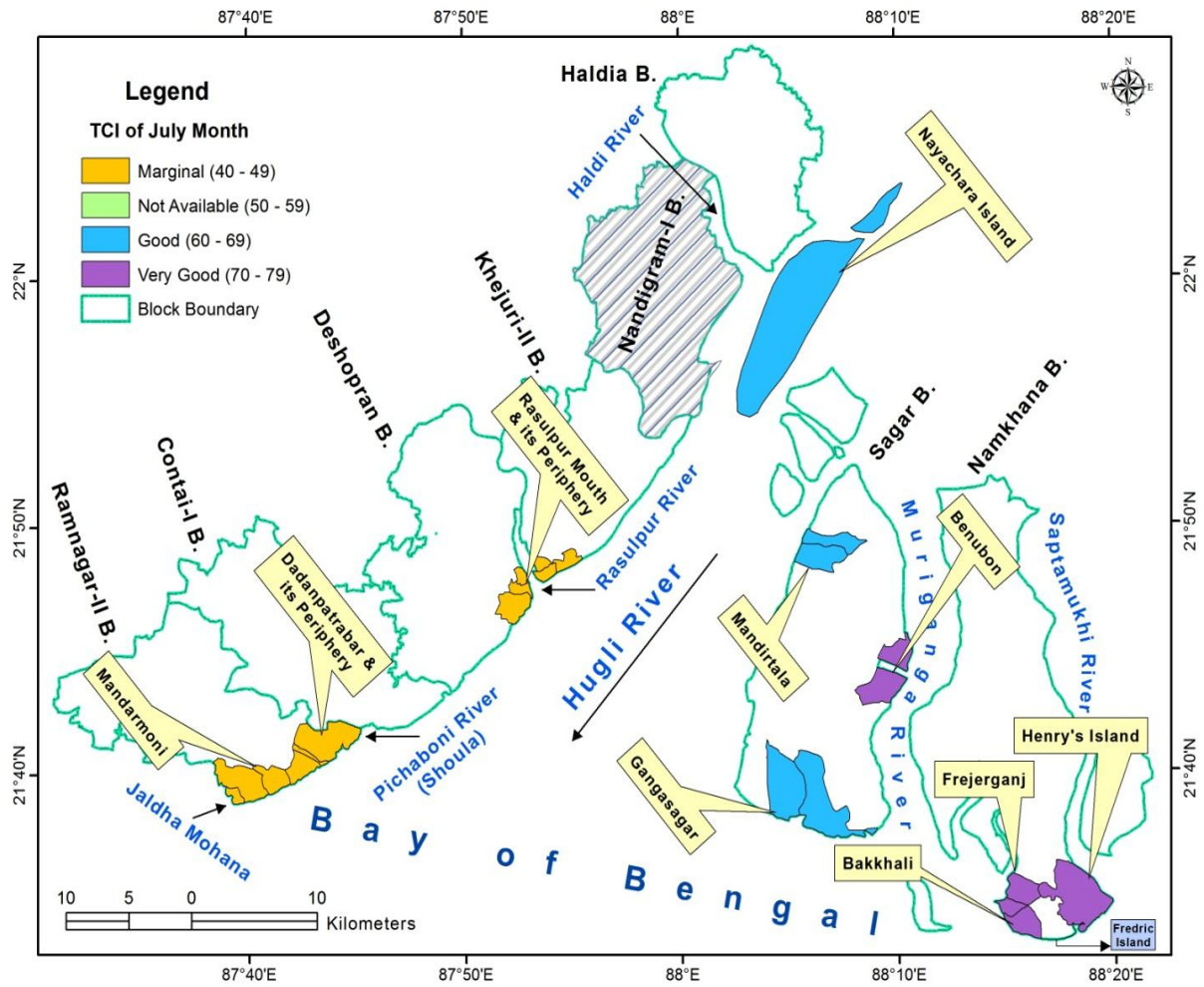


Fig. 4.7: TCI map for the month of July in the ecotourism destination sites.

4.4.7 TCI Value for the Month of July

In the month of the July, the climatic conditions same (Fig. 4.7; Table 4.5) as it is in the month of June. The Benubon (71.86), Bakkhali (71.86), Henry’s Island (74.97) and Frejerganj (71.86) have the very good climatic condition. Whereas, Nayachar Island (62.46), Mandirtala (62.46), Gangasagar (62.46) have the good climatic condition. The Mandarmani (49.41), Dadanpatrabar (49.41) and Rasulpur (49.41) have marginal climatic condition for the tourists.

4.4.8 TCI Value for the Month of August

In the month of August, the TCI shows that (Fig.4.8; Table 4.5) the Benubon (72.61), Bakkhali (72.61), Henry’s Island (73.55) and Frejerganj (72.61) have the very good climatic condition. Nayachar Island (64.95), Mandirtala (64.95) and Gangasagar (64.95) have good climatic condition. The Mandarmani (54.8), Dadanpatrabar (54.8) and Rasulpur (54.8) have the acceptable climatic conditions for the tourists.

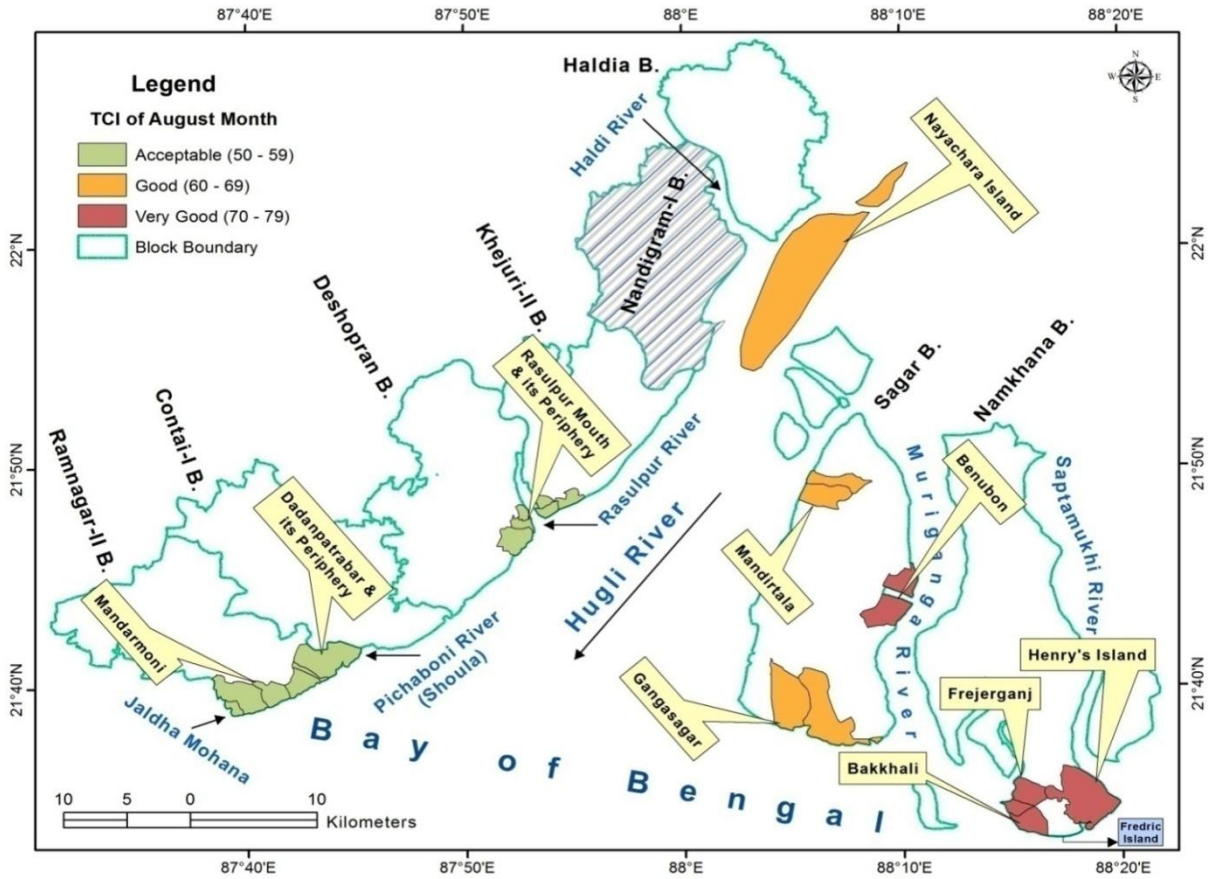


Fig.4.8: TCI map for the month of August in the ecotourism destination sites.

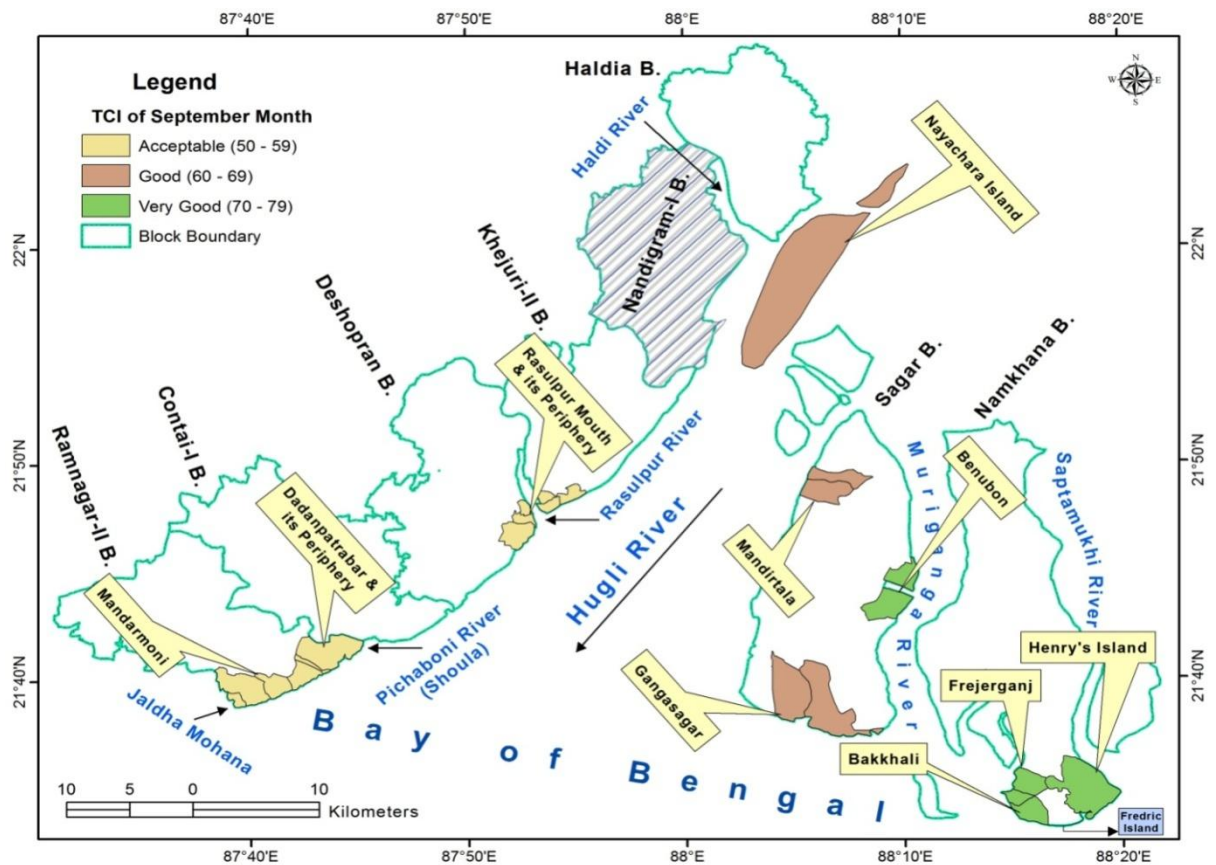


Fig.4.9: TCI map for the month of September in the ecotourism destination sites.

4.4.9 TCI Value for the Month of September

The TCI for the month of September reveals that (Fig.4.9; Table 4.5) the Benubon (70.75), Bakkhali (70.75), Henry’s Island (71.5) and Frejerganj (70.75) have the very good climatic condition. The Nayachar Island (62.29), Mandirtala (62.29) and Gangasagar (62.29) have the good climatic condition for the tourists. The Mandarmani (50.22), Dadanpatrabar (50.22) and Rasulpur (50.22) have the acceptable climatic condition for the tourists in the coastal destinations sites.

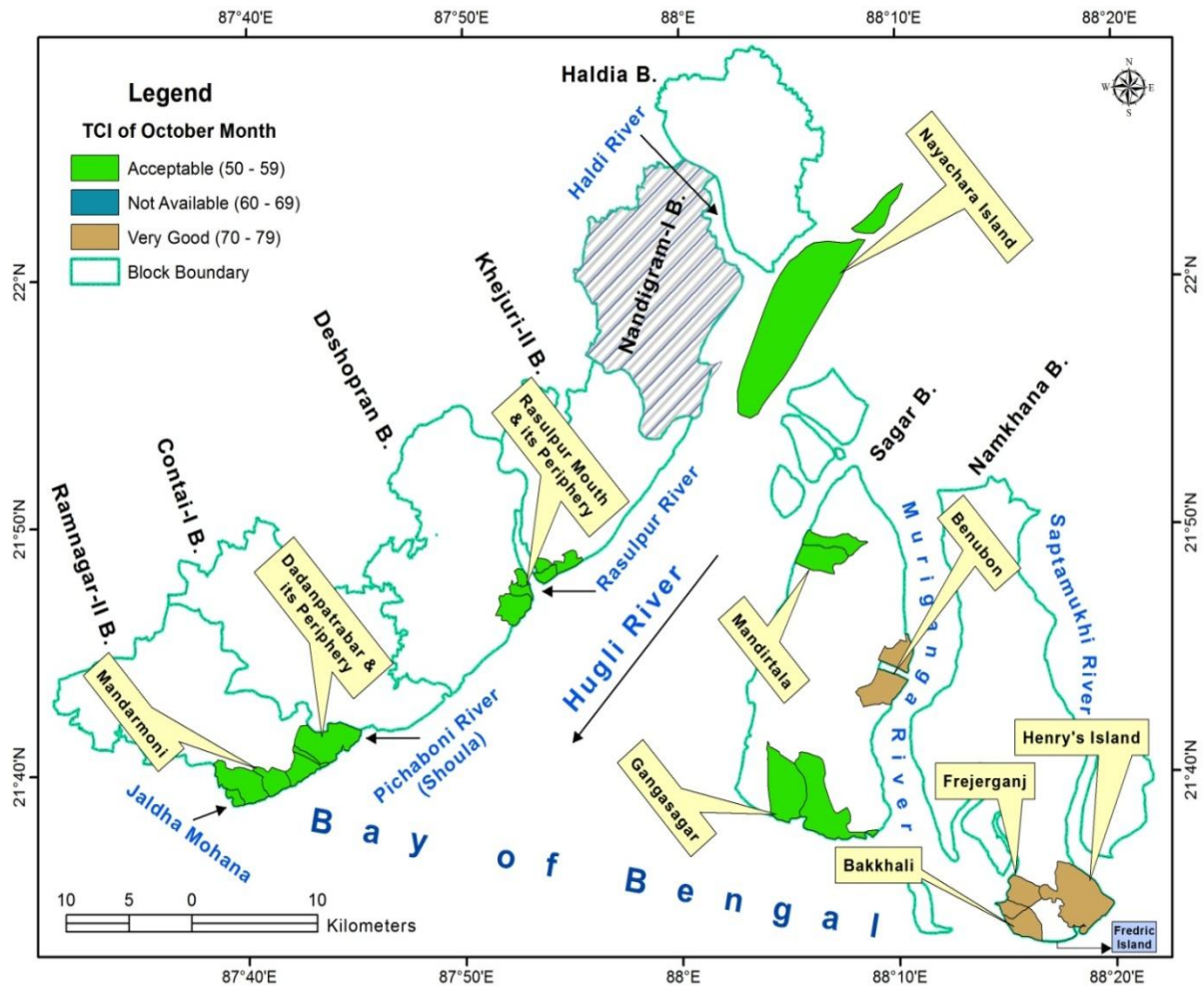


Fig.4.10: TCI map for the month of October in the ecotourism destination sites.

4.4.10 TCI Value for the Month of October

In the month of October, the TCI shows that (Fig. 4.10; Table 4.5) the climatic conditions for the coastal destinations are favorable. The Benubon (75.30), Bakkhali (75.30), Henry’s Island (75.5) and Frejerganj (75.30) have the very good climatic conditions. The Mandarmani (54.80), Dadanpatrabar (54.80), Rasulpur (54.80), Nayachar Island (60.43), Mandirtala (60.43) and Gangasagar (60.43) have the acceptable climatic conditions for the tourists.

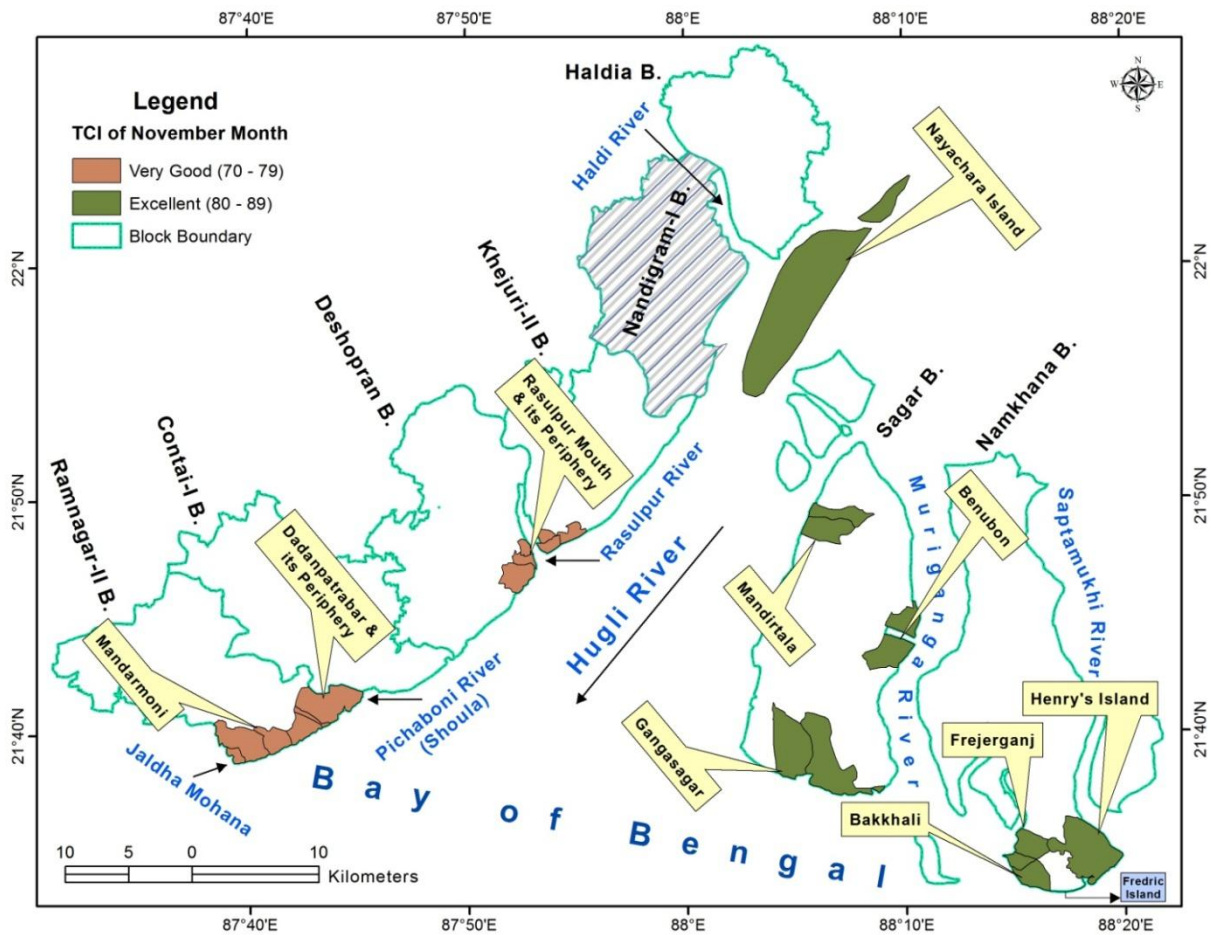


Fig.4.11: TCI map for the month of November in the ecotourism destination sites.

4.4.11. TCI Value for the Month of November

The winter season starts in the month of November and the climatic conditions are very comfortable for the coastal tourists. The TCI of that month shows that (Fig. 4.11; Table 4.5) the Nayachar Island (82.21), Mandirtala (82.21), Gangasagar (82.21), Benubon (78.69), Bakkhali (78.69), Henry’s Island (80.16) and Frejerganj (78.69) get the excellent climatic conditions for the tourists. The Mandarmani (77.13), Dadanpatrabar (77.13) and Rasulpur (77.13) have very good climatic conditions for the tourists in the coastal destination sites of the study area.

4.4.12 TCI Value for the Month of December

The climatic condition in the month of December is very much comfortable. Therefore, the TCI result of that month reveals that (Fig. 4.12; Table 4.5) the Mandarmani (83.83), Dadanpatrabar (83.83), Rasulpur (83.83), Nayachar Island (81.64), Mandirtala (81.64), Gangasagar (81.64) and Henry’s Island (76.66) the excellent climatic condition. However, in the remaining destination sites of Benubon (74.5), Bakkhali (74.5) and Frejerganj (74.5) are perceived as good climatic conditions for tourist recreation activities.

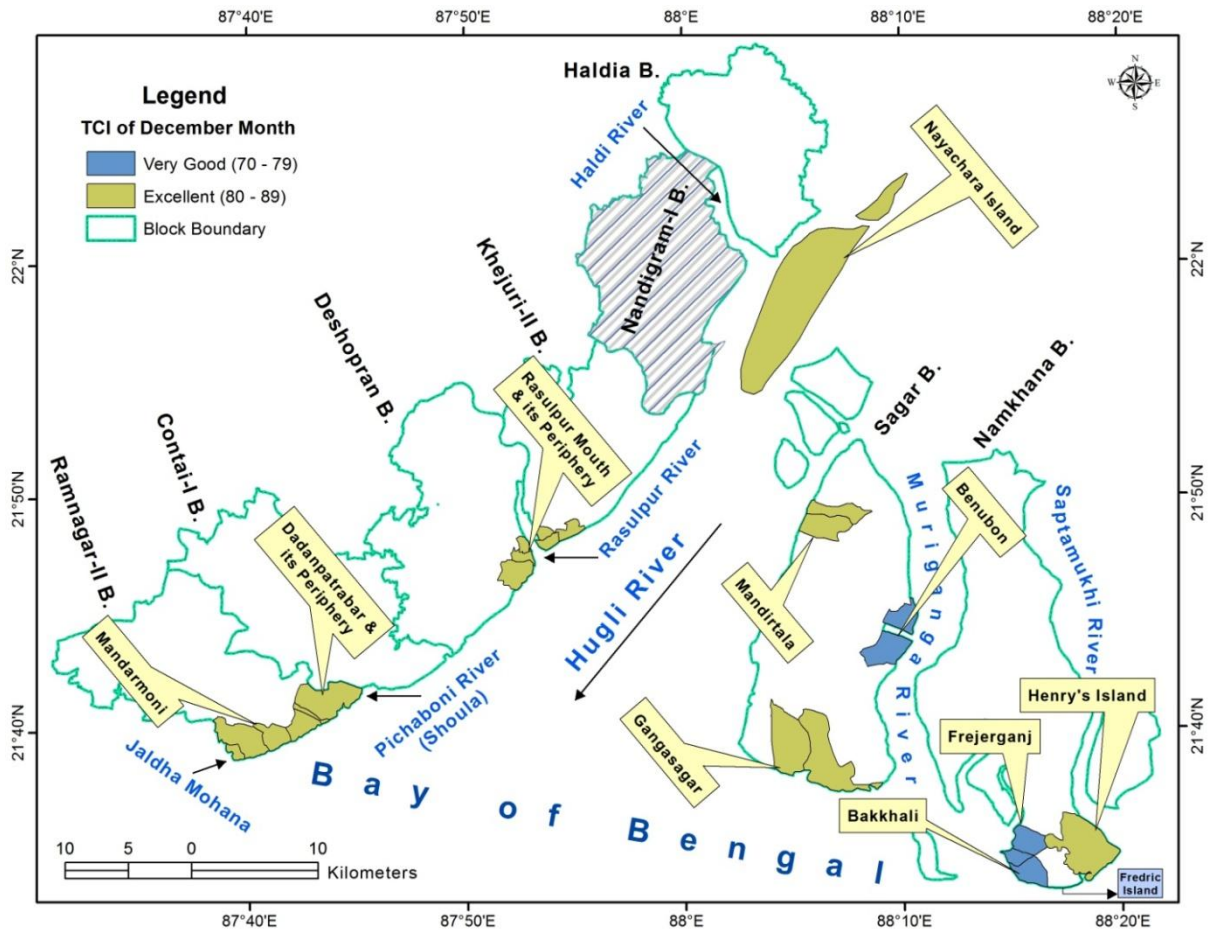


Fig.4.12: TCI map for the month of December in the ecotourism destination sites.

The overall climatic condition of the 12 months of the entire study area shows that the month of June is most unfavorable conditions for tourism activities in the coastal destinations. However, in to some extent the tourism activities are acceptable in few sites. In few destinations, during the month of May and July the tourism activities are accepted with the support of the recreational activities by the tourists. But, the marginal TCI prevails for some destinations due to hot and humid condition coupled with the occurrences of low pressures and cyclonic behavior of the coastal region in the destinations. However, the months of March, April, August, September and October are acceptable for playing the recreational activities with good quality of TCI. Only the months of January, February, November and December are the most favorable months for playing the safe recreational activities in coastal tourism destinations. These months are most favorable for the tourist’s movements in the destinations. During this time the tourism pressure is maximum in the coastal destinations. In the year of 2014-15 the survey result suggest that in the month of January 2015 (7768121) is the peak months for domestic tourist and the lowest tourist pressure is seen in during the months of June 2014 and May 2014 (AFRT, 2015).

Table 4.7: Hotel survey record of Mandarmani and Bakkhali in the peak season.

Sl.No	Hotel Name of Mandarmani	No. of Rooms	Drinking Water Sources Depth in Ft	No. of Employee	Food Quality	No. of Visitors Per Month	Marine Food Available	Distance From the Sea Shore in m
1	Calypso Hotel &Resort	15	810	10	Good	500	Yes	200
2	J.P. Resort	25	120	12	Better	400	Yes	80
3	Megha Hotel	120	580	10	Good	350	Yes	2
4	Moinak Hotell	21	950	08	Normal	200	Yes	2
5	Bela Bhumi	14	700	12	Good	250	Yes	40
6	Srinjini Resort	24	180	10	Good	300	Yes	1000
7	Sonar Goan Resort	16	600	14	Good	500	Yes	50-60
8	Ma Sarada Moyee Resort	22	150	08	Normal	400	Yes	50
9	Oak Resort	14	550	05	Normal	450	Yes	7
10	Golden Beach Resort	12	600	10	Good	500	Yes	3
11	The Landle Wood Park	19	250	05	Good	400	Yes	2
12	Muktaarphot Resort	30	450	10	Good	500	Yes	2
13	Monsoon Resort	18	1100	08	Good	450	Yes	2
14	Blue Lagoon	12	750	10	Good	450	Yes	3
15	Star Inn	22	700	10	Normal	500	Yes	50
Hotel's of Bakkhali								
1	Hotel Monalisha	25	1100	04	Good	500	Yes	450
2	Hotel Balaka	35	1100	08	Good	650	Yes	600
3	Hotel Amantran	12	1100	02	Good	430	Yes	500
4	Hotel Triva	25	1000	04	Good	500	Yes	500
5	Hotel Amaravati	40	1000	04	Good	400	Yes	500
6	Hotel Rainbow	30	1100	05	Good	600	Yes	650
7	Icon Heritage	15	1000	04	Good	500	Yes	500
8	Narayani Lodge	34	980	08	Good	500	Yes	500
9	Bakkhali Tourist Lodge	120	1000	23	Good	600	Yes	500
10	Hotel Sanjog	40	950	06	Good	650	Yes	500
11	Hotel Chitrakut	30	950	10	Good	500	Yes	500
12	Hotel Welcome	15	1000	08	Good	500	Yes	450
13	Hotel Saathi	03	900	06	Good	450	Yes	750
14	Village Guest House	30	700	04	Good	600	Yes	1500
15	Vijaya Tourist Lodge	14	900	02	Good	600	Yes	400

Source: Field survey at (2018) in Mandarmani and Bakkhali

However, in the case for the foreign tourists the tourist pressure is same all over the year (Fig. 4.13). However, during these months all the hotels and restaurants are able to

accommodate the tourists and provide the local foods or marine foods at their optimum level. The result also reveals that the hotel and restaurants of the tourists’ destinations earn a maximum profit during the favourable climatic condition of this period (Table 4.7).

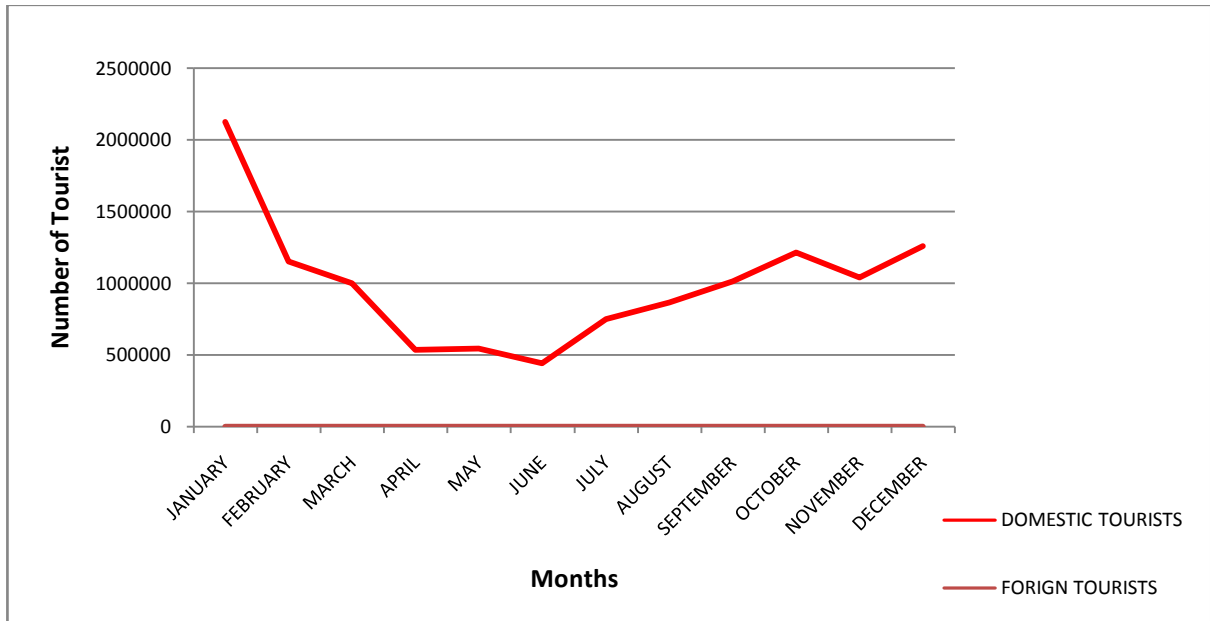


Fig.4.13: Tourist flow during (2014-15) months wise in the destination sites.

Table 4.8: TCI value for monthly variation (1-15days) in the ecotourism destination sites.

Tourism Destinations	Janu ary	Febru ary	Mar ch	Ap ril	Ma y	Ju ne	Jul y	Aug ust	Septem ber	Octo ber	Novem ber	Decem ber
Mandarm ani	81.30	76.11	54.72	49.88	44.47	38.05	46.08	57.91	55.52	52	71.08	83.73
Dadanpatr abar	81.30	76.11	54.72	49.88	44.47	38.05	46.08	57.91	55.52	52	71.08	83.73
Rasulpur	81.30	76.11	54.72	49.88	44.47	38.05	46.08	57.91	55.52	52	71.08	83.73
Nayachar	79.04	83.62	59.52	52.40	51.09	41.61	60.22	65.39	61.78	55.74	80.12	82.53
Mandirtal a	79.04	83.62	59.52	52.40	51.09	41.61	60.22	65.39	61.78	55.74	80.12	82.53
Gangasag ar	79.04	83.62	59.52	52.40	51.09	41.61	60.22	65.39	61.78	55.74	80.12	82.53
Benubon	72.08	74.72	84.02	77	68.05	52.88	72.52	72.58	71.41	74.11	79.41	76.25
Bakkhali	72.08	74.72	84.02	77	68.05	52.88	72.52	72.58	71.41	74.11	79.41	76.25
Henry’s Island	74.16	78.25	85.36	64.97	55.97	48.77	70.11	74.86	72.13	69.91	81	78.02
Frejerganj	72.08	74.72	84.02	77	68.05	52.88	72.52	72.58	71.41	74.11	79.41	76.25

The average monthly temperature and precipitation of the tourism destinations are not varied significantly. Therefore, the monthly average weather parameters have been further categorized into first half (1 – 15 days) and second half (16 – 30 days) (Table 4.7 and 4.8) of a month to assessed the intensive relationship between the climatic variability and the tourists’ flow in the different destination sites of the study area. The TCI is further analyzed based on the equation (4.1 and 4.2) considering the bi-monthly climatic variables.

Table 4.9: TCI value for monthly variation (16-30days) in the ecotourism destination sites.

Tourism Destinations	January	February	March	April	May	June	July	August	September	October	November	December
Mandarmani	82.16	61.86	53.58	47.44	43.72	41.46	53.47	56.41	50.72	61.80	82.22	83.25
Dadanpatrabar	82.16	61.86	53.58	47.44	43.72	41.46	53.47	56.41	50.72	61.80	82.22	83.25
Rasulpur	82.16	61.86	53.58	47.44	43.72	41.46	53.47	56.41	50.72	61.80	82.22	83.25
Nayachar	81.17	73.87	54.36	51.55	47.59	54.18	62.43	64.30	58.34	66.36	82.46	80.94
Mandirtala	81.17	73.87	54.36	51.55	47.59	54.18	62.43	64.30	58.34	66.36	82.46	80.94
Gangasagar	81.17	73.87	54.36	51.55	47.59	54.18	62.43	64.30	58.34	66.36	82.46	80.94
Benubon	72.69	79.05	88.44	72.11	64.22	62.66	73.36	73.55	71	77.11	78.63	73.83
Bakkhali	72.69	79.05	88.44	72.11	64.22	62.66	73.36	73.55	71	77.11	78.63	73.83
Henry’s Island	74.97	79.16	78.66	60.16	51.05	62.69	75.88	74.22	66.22	76.97	80.38	77
Frejerganj	72.69	79.05	88.44	72.11	64.22	62.66	73.36	73.55	71	77.11	78.63	73.83

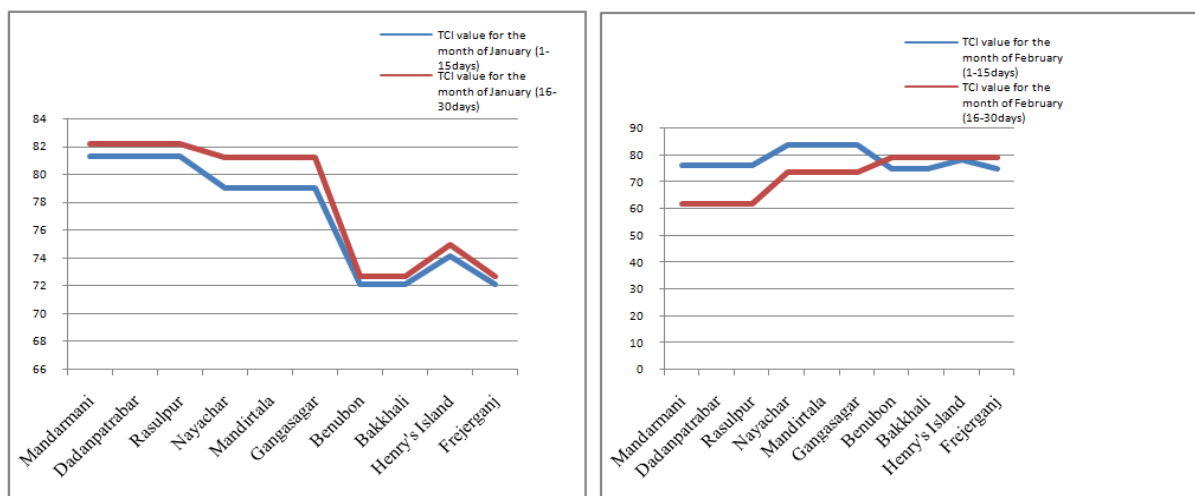


Fig. 4.14: TCI value of the coastal tourism destinations in January and February months (1-15&16-30days).

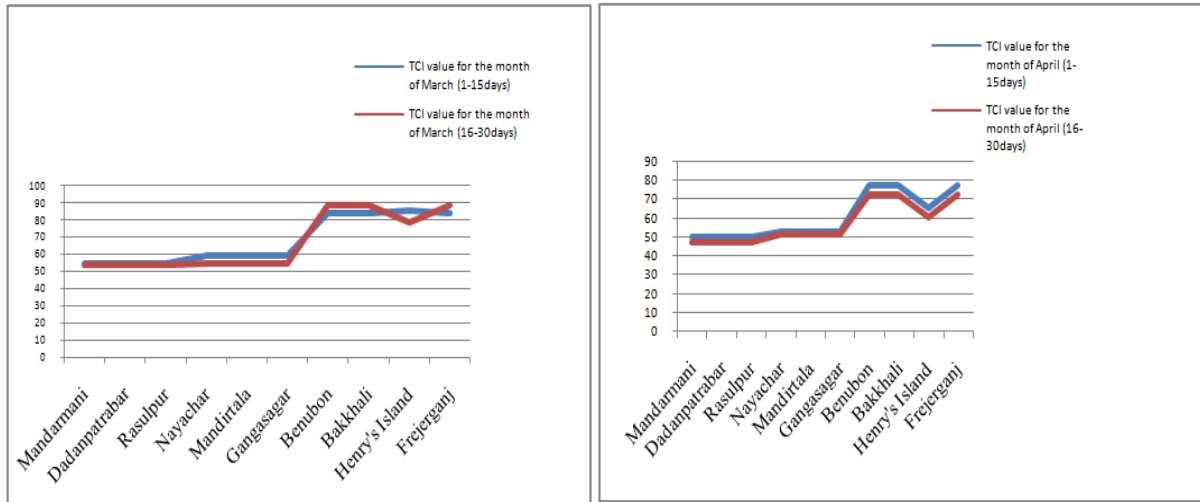


Fig. 4.15: TCI value of the coastal tourism destinations in March and April months (1-15 &16-30 days).

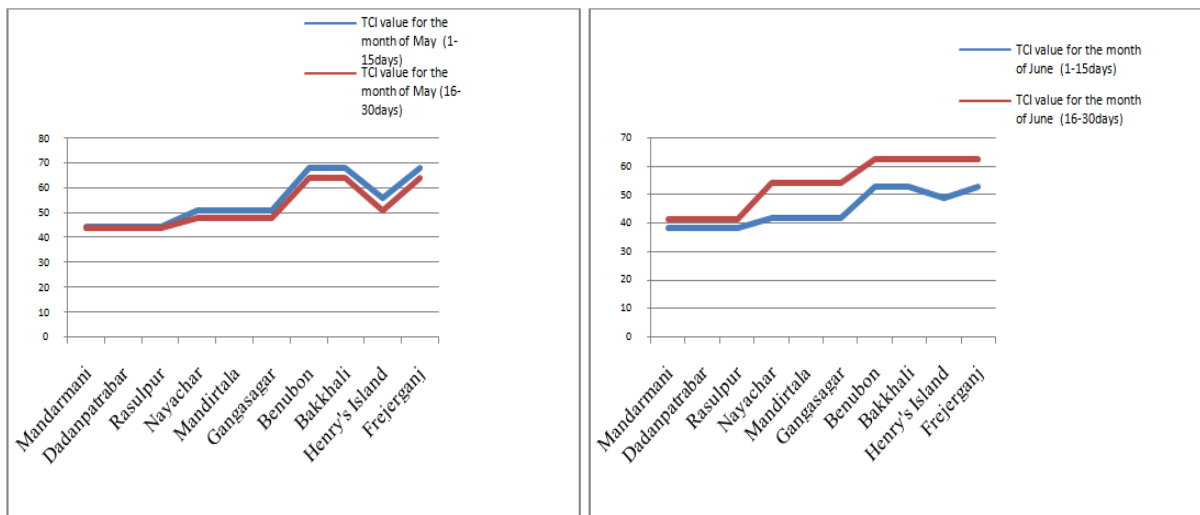


Fig. 4.16: TCI value of the coastal tourism destinations in May and June months (1-15 &16-30 days).

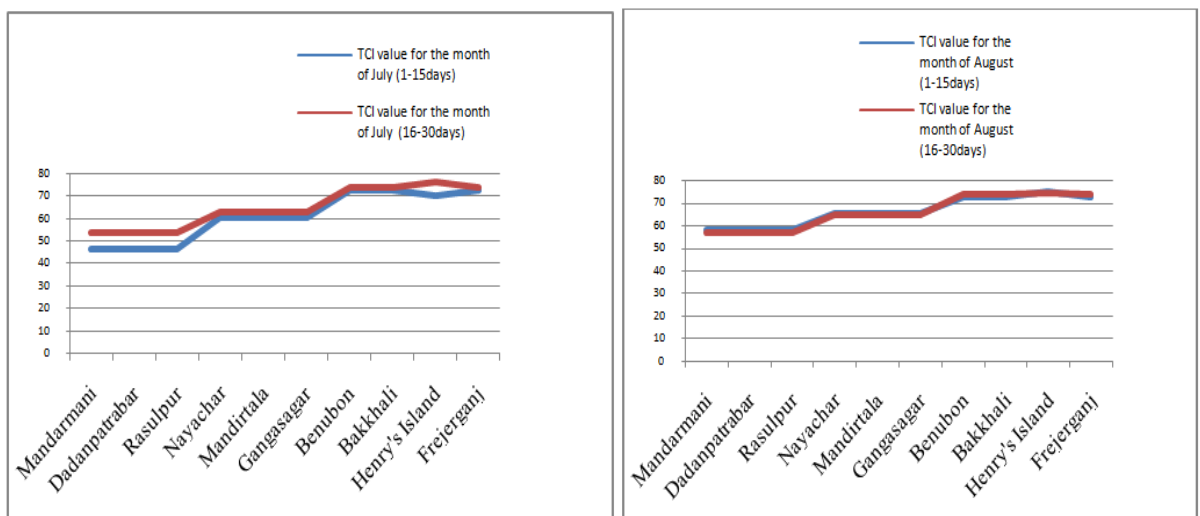


Fig. 4.17: TCI value of the coastal tourism destinations in July and August months (1-15 &16-30 days).

After analysis of the first half (1-15 days) (Annexure 66, 69, 72, 75) and second half (16-30days) (Annexure 67, 70, 73, 76) of the monthly climatic parameters, the results shows that the TCI value for each month in each destination is moreover same (Fig. 4.14, 4.15, 4.16, 4.17, 4.18 and 4.19). Therefore, the monthly average of TCI value is ideal for the tourists in the coastal area for their recreation and health comfort.

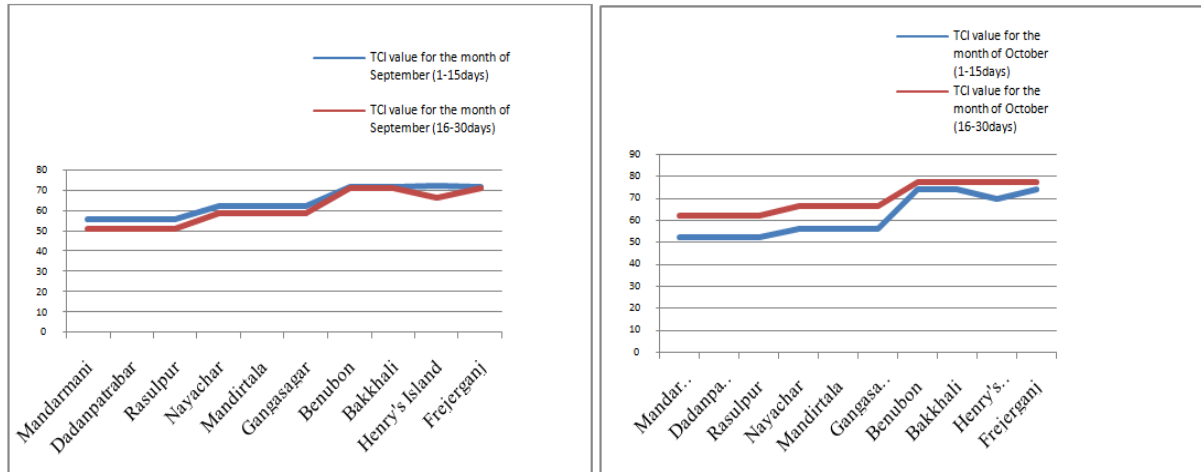


Fig. 4.18: TCI value of the costal tourism destinations in September and October months (1-15 &16-30 days).

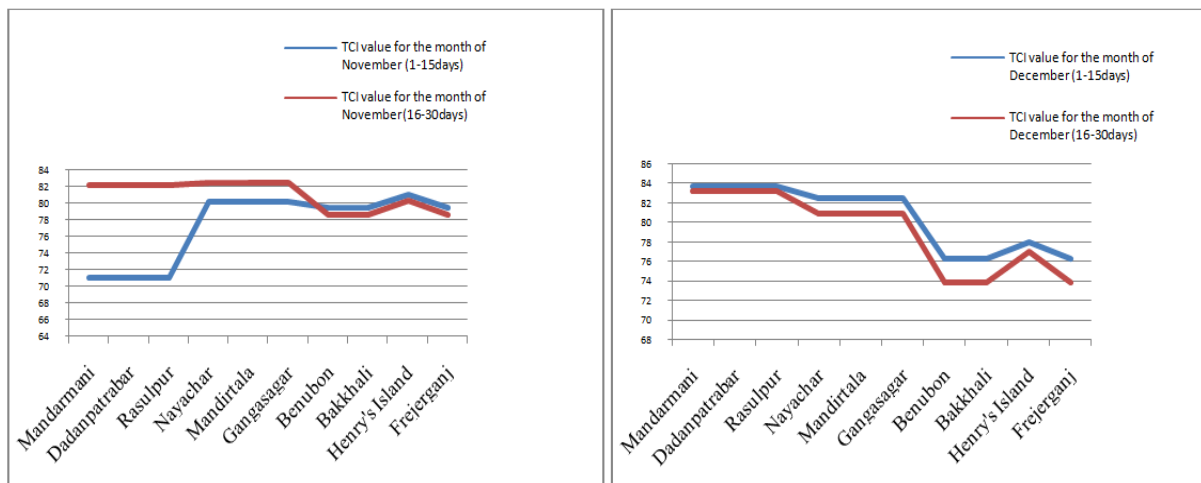


Fig. 4.19: TCI value of the costal tourism destinations in November and December months (1-15 &16-30 days).

The climatic condition of the coastal area is changeable and the seasonal characteristics of the region are based on some indicator (Table 4.10) and depend on that there are four seasons is found in the region. LST can support some important information about weather and climatic parameters of the region (Fig. 4.20). The concern study analyses the TCI indexing in the coastal region to predict the tourist comfort for each destination of each month in the study area. The result suggests that the autumn and winter are favourable season for the tourist arriving in the destination sites.

Table 4.10: Characteristic of the different season.

Seasonal Characteristics Indicator	Season of Summer	Season of Monsoon	Season of Autumn	Season of Winter
Attractions	Good	Rainy phase	High attraction	High attraction
Sky conditions	Clear	Cloudy	Low clouds	Clear sky
Precipitation	Nor'wester	Rainy	Low	Rainless
storm	Rare	Low pressures	Frequent occurrence	No storm
Humidity	Moderate	Very high	High	Very low
Sand blown activities	High impact	No impact	Little amount	Calm
Occurrences of flood	No	Occurrences of flood	Occurrences of flood	No flood
Green Environment	Low	Good	Very good	Good
Favourable Sea bathing conditions	Good	Risky	Risky	Good
Good Accessibility	Good	Low	Moderate	High

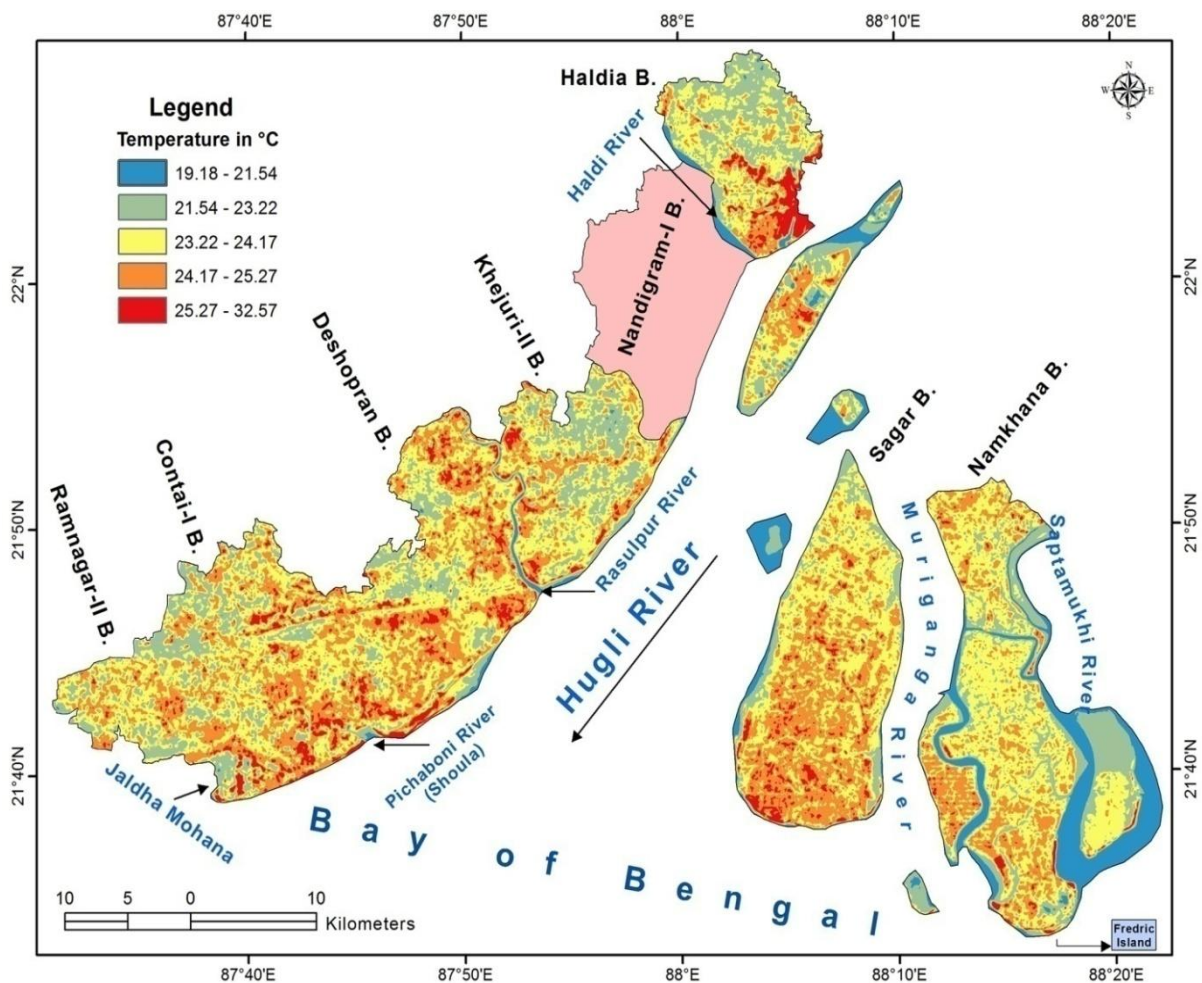


Fig. 4.20: LST (Land Surface Temperature) of the coastal destinations.

4.5. Seasonal Characteristics of the Coastal Destinations

4.5.1 Summer

In the summer season the range of temperature is from 20°C to 40°C with a very sweltering and humid climatic condition. During this season, particularly in the month of April the high temperature insist the other climatic disturbances like activity of windblown sand, the formation of low pressures, depression and cyclonic storms in the coastal areas. Therefore, the season is not to be recommended for the tourists.

4.5.2 Monsoon

In the coastal region the monsoon season is start from the month of June and prolonging its activities up to the end of September. Although, in the month of July the climatic condition is vulnerable as during this period the southwestern monsoon is very active with the occurrences of low pressures and cyclonic storms in the coastal areas. The monsoonal months are very dangerous for tourist's activities as the sea condition is not favorable.

4.5.3 Autumn

In the season of autumn, the climatic condition remains calm as the sky remain clear and the comfortable temperature. Such kind of weather condition is preferred by the tourists. Therefore, tourists are enjoying their holidays from the month of October to the middle of November in the coastal areas.

4.5.4 Winter

During the winter season in the coastal area the tourists' pressure become very high. The comfortable climatic condition is favored for tourists' leisure and recreational activities in the destination sites. However, the above indexing ([Table 4.10](#)) reveals that the autumn and winter season is favorable for tourists' comfort and leisure activities in the entire destination sites.

4.6 Major Findings:

- TCI is the most ideal index that analysis the relationship between the climatic condition and it's affect on the human well being and their activities.
- January, February, November and December are most favourable month for the tourists arriving in the all coastal tourism destinations sites of the study area.

- In the month of March Mandarmani, Dadanpatrabar, Rasulpur, Nayachar, Mandirtala and Gangasagar are acceptable climatic condition and Benubon, Bakkhali, Henry's Island and Frejerganj have the excellent climatic condition for travelling the tourists.
- In the month of April Mandarmani, Dadanpatrabar, Rasulpur have the marginal climatic comfort, Nayachar, Mandirtala, Gangasagar have the acceptable condition and Benubon, Bakkhali, Henry's Island and Frejerganj have very good climatic comfort condition for the tourists.
- In the month of May Mandarmani, Dadanpatrabar, Rasulpur, Nayachar, Mandirtala, Gangasagar have marginal climatic comfort and Benubon, Bakkhali, Henry's Island, Frejerganj have the good climatic comfort in the coastal destinations.
- In the month of June Mandarmani, Dadanpatrabar, Rasulpur have the unfavorable climatic condition for the tourists and in Nayachar, Mandirtala, Gangasagar climatic condition is marginal and in Benubon, Bakkhali, Henry's Island and Frejerganj the climatic comfort is good.
- In the month of July the climatic comfort for the coastal tourism destinations sites Mandarmani, Dadanpatrabar, Rasulpur is marginal and in Nayachar, Mandirtala, Gangasagar is good and Benubon, Bakkhali, Henry's Island and Frejerganj the climatic comfort condition is very good.
- In the month of August, September and October the climatic comfort condition for the Mandarmani, Dadanpatrabar, and Rasulpur is acceptable, in Nayachar, Mandirtala and Gangasagar is good and in Benubon, Bakkhali, Henry's Island and Frejerganj the climatic comfort condition is very good.