Life Science Informatics Publications

Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences

Journal Home page http://www.rjlbpcs.com/

RJLBPCS

ISSN 2454-6348

Original Research Article **DOI - 10.26479/2016.0203.08**

EFFECT OF ENVIRONMENTAL ELEMENTS ON MIGRATION PATTERN OF EAGLES AT JORBEER CONSERVATION RESERVE, BIKANER, RAJASTHAN, INDIA

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ABSTRACT: The present endeavor was carried out to find out the effect of environmental elements on migration pattern of eagles at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India (JCRBRI) during period from April 2015 to July 2016. The eagles studied were steppe eagle (*Aquila nipalensis*) and greater spotted eagle (*Clanga clanga*). The greater spotted eagle was seen only from November to February reiterating their winter migration to this reserve. Steppe eagle stayed at reserve during various months of the study year 2015 and 2016 when the THI values varied as 56.64-79.5. Recording of count of steppe eagle and greater spotted eagle besides real-time observation of environmental temperature and humidity signified in monitoring of eagle residence in the region. Result of the endeavor assisted in comprehending the absence of eagles in summer months during study periods. Residential period of steppe eagle was from November to April and of greater spotted eagle was from November to February only. Maximum THI value threshold of steppe eagle was 79.5 and of greater spotted eagle was 72.5. A greater per cent (75-100%) of eagles exhibited a winter migratory pattern at JCRBRI from November to February when THI was 72 or low and minimum environmental temperature was from 6 to19 ^{0}C.It can be inferred that greater spotted eagle was a winter migrant in stringent logic. However, steppe eagle showed a slight variation and was also observed during March and April months and had a higher THI value threshold comparatively. It can be deduced that eagles have awareness in assessing feeding

Peer review under responsibility of Life Science Informatics Publications

strategies along with apt environmental conditions for harbouring. The study will assist in comprehending the fine points of eagle's migratory behaviour and variations in environmental components.

KEYWORDS: Conservation, greater spotted eagle, Jorbeer, migration, steppe eagle, temperature-humidity index

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1.INTRODUCTION

The analysis of migration of eagles as a universal concern is among the most credible and demanding issues of contemporary scientific research with chief implications on conservation. Inherent changes in the convenience of decisive halts in connection with devastation of fenlands and expected trounces of environmental dissimilarities put migratory birds in a quandary. Cumulative populace for a species at migration sites can provide vague divergence among separate populations at any other specified locale and that individual reckoning by time period can be a practical way to verify for disparities among sub-populations [1]. Greater densities of migratory birds indicate a higher value of the landscape for biodiversity and ecosystem services. Migrants concoct journeys to and from their breeding and halting places each year in sizeable numbers. Verification and figuring out the migration of eagles is imperative from scientific and technical purposes. Know-how of resilience of migrants towards harsh environments is a burning issue among scientific community. This knowledge can also contribute towards validation of the course of migrating birds. Candid distinction in a time frame from one phase to another is a method to put together the data and to obtain consequential association amid changeable components. Visual approaches make the specific aspects of bird clear at migratory halts. Researchers have strived hard to connect environmental parameters with the travelling pace of migrants [2]. By employing space based technology in a perspective of bird migration model can impart innovative tools to direct knowledge about environmental threats, migratory behaviour and human interlude. Atmospheric changes are associated with the alteration in physiological mechanisms of birds like energetic. Eagles are known to adjust airspeed in relation to headwind speed [3]. The steppe eagle (*Aquila nipalensis*) is a bird of prey and has undergone extremely rapid population declines. Therefore field

observations are important not only to find out the number but also from health point of view as there are countable few studies to find out about the health aspect in the eagle [4].The greater spotted eagle (*Clanga clanga*) or spotted eagle is a large bird of prey. Both eagles belong to the family Accipitridae. Very little is known about eagle migration, their foraging areas and wintering perch. Current research indicates that various migrants of a species may show a widespread position in an area. Feeding habits are associated with the specificity of species and individual. Most acceptable theory visualizes that inhabitants will select the upbeat and buoyant environment for residence. A primary notion in geographical ecosystem is that spatial heterogeneity influences biological systems. It can be anticipated that inhabitants with an extensively recognized area must have availability of food with environmental security, suggesting beneficial biodiversity. Agricultural assortment have affected the migratory routes to a larger extent. There are several ways by which the environment can contrive migration of birds. Temperature and humidity are vital elements of environment which can whack upon deeply on migratory competence. Eagles migrating larger distances are stumbled with varying spatial information. There is scarcity of research on these aspects in eagles. Hence the present study was initiated with the objective to follow eagles' migration pattern in view of environmental temperature and humidity at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India (JCRBRI).

2.MATERIALS AND METHODS

The investigation was carried out to find out the effect of environmental elements on migration pattern of eagles at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India (JCRBRI). The eagles included in the study were steppe eagle (*Aquila nipalensis*) and greater spotted eagle (*Clanga clanga*). The area selected for the investigation was Jorbeer Conservation Reserve, Bikaner, Rajasthan, India (JCRBRI) which comprised of 56.46 km^2situated south east to Bikaner at distance of 12 Km with a geographical position of 20'30 north latitude and 73'50 east longitudes at height of 234.84m mean sea level. Bikaner, a district in the dry *Thar*desert, is located in the northwest of the state of Rajasthan in north India. To determine effect of environmental elements on eagle migration, data were collected over a period of 16 months from April 2015 to July 2016 and were analysed. Eagle population influx was recorded visually along with environmental correlates (temperature and relative humidity) on 1^{st} and 15^{th} day of each month. The environmental elements i.e. temperature and humidity were recorded by using portable instrument (Atmospheric Data Centre Pro, Brunton, USA) and THI was determined as described by Gantner *et al.* [5].

3. RESULTS AND DISCUSSION

Population of eagles (Greater spotted eagle and steppe eagle) in numbers at JCRBRI from April 2015 to July 2016 is depicted in fig.1and 2, respectively. From May to October, 2015, steppe eagle was not evidenced. Steppe eagle number started increasing from November 2015 and reached a peak of 600 in

Fig.1: Greater spotted eagle population at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India

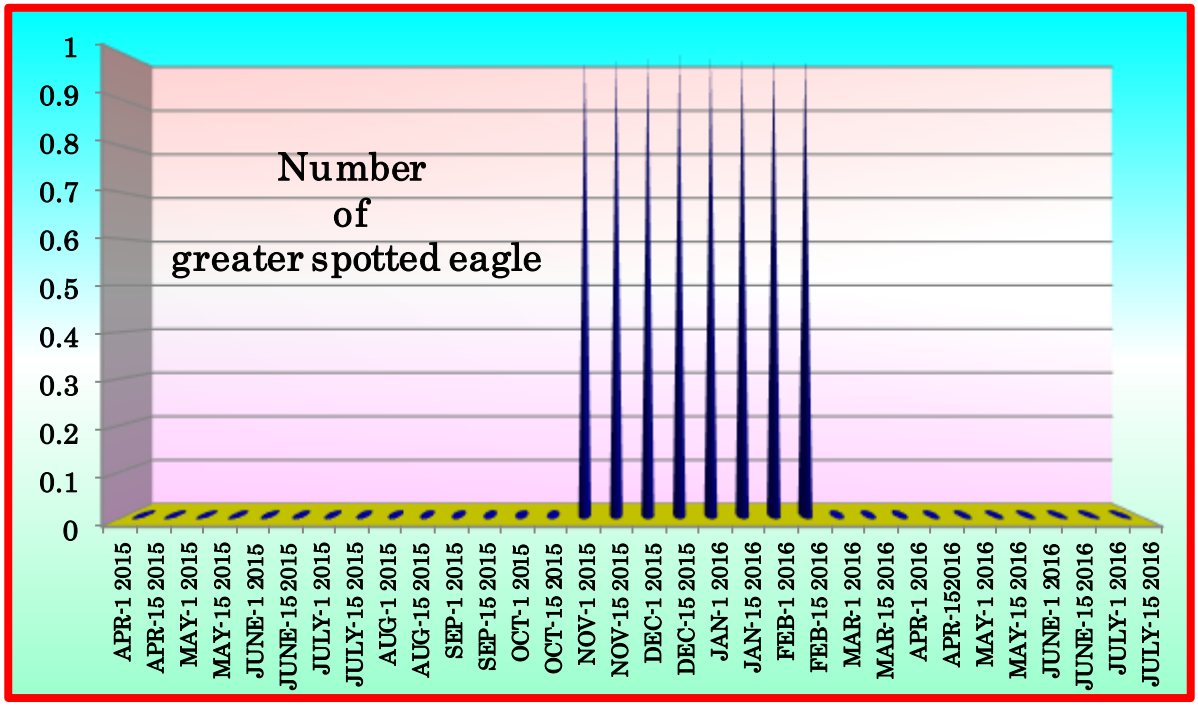
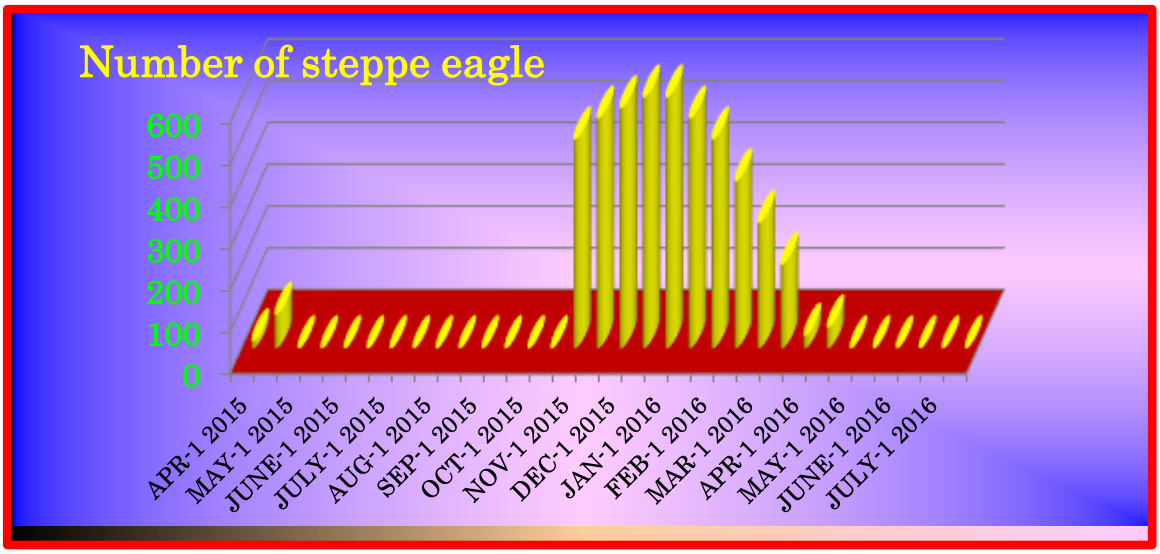


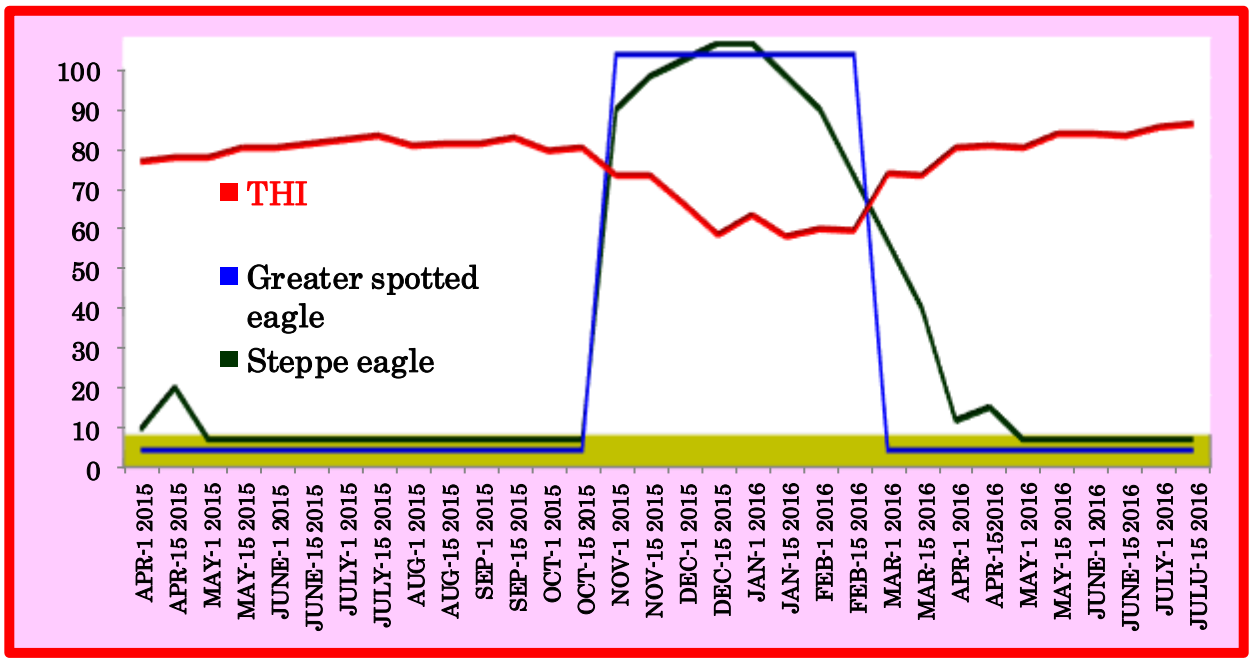
Fig.2: Steppe eagle population at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India



mid of December and was maintained till beginning of January 2016.Then number started decreasing and in the month of May no steppe eagle was observed. Only one Greater spotted eagle was observed from November 2015 till February 2016. Other months of the study period did not evidence the presence of greater spotted eagle.

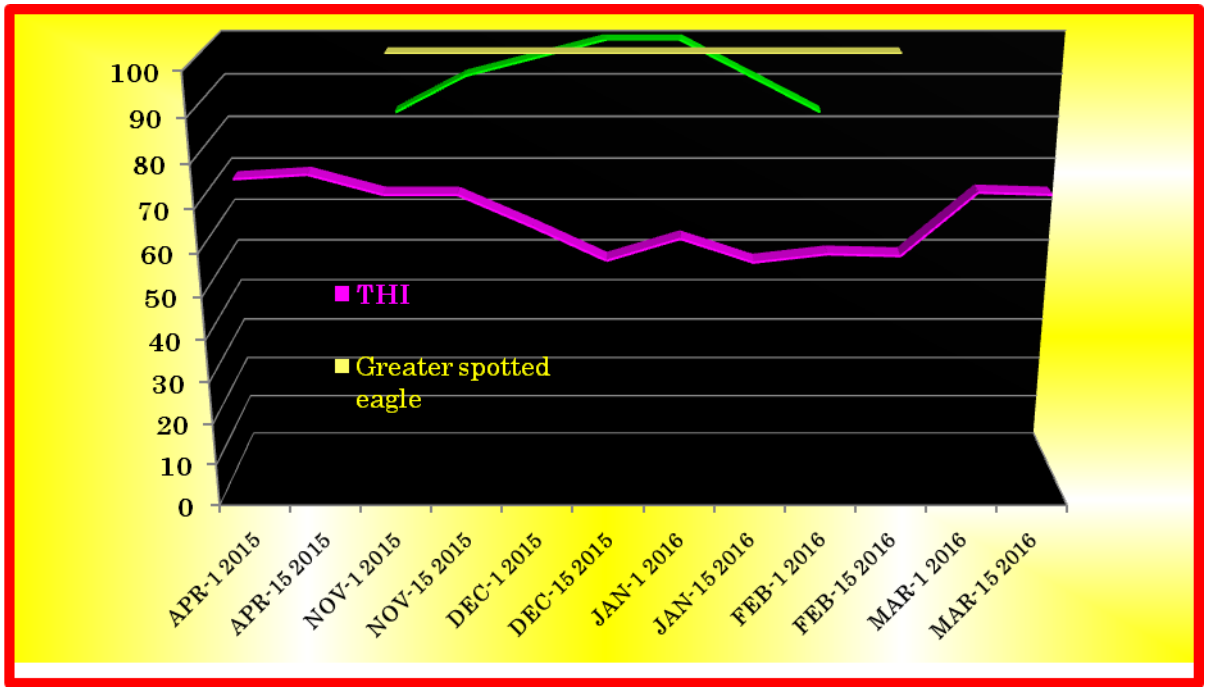
Fig. 3 depicts eagle population (%) versus temperature humidity index values (THI) at JCRBRI from April 2015 to July 2016. In April, 2015 the THI values dangled between 75.5 and 76.5, and per cent population of steppe eagle varied as 2.83-13.33%. Steppe eagles were absent from May to October, 2015 whereas greater spotted eagles were absent from April to October, 2015.During the absence period of eagles, THI varied as 76.5-81.5.November to February illustrated THI values as 72 and lower, and population per cent of steppe eagle and greater spotted eagle varied as 66.67-100% and 100%, respectively. In the March 2016, THI varied between 72 and 72.5, and per cent of steppe eagle and greater spotted eagle varied as 33.33-50% and 0%, respectively. From April to July, 2016, THI varied between 79 and 85, and per cent of steppe eagle and greater spotted eagle varied as 0-8.33% and 0%, respectively.

Fig. 3: Eagle population (%) versustemperature humidity index values (THI) at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India



The THI values at which majority (75-100%) of eagles preferred to stay at reserve are represented in fig.4. All the eagles chosen to live in the conserve when the THI values were comparatively lower. At 75-100% population of steppe eagle and greater spotted eagle, the THI

Fig.4: Representation of 75-100% eagles' population (%) with THI valuesat Jorbeer Conservation Reserve, Bikaner, Rajasthan, India



values varied as 56.64-72 and 56.64-72, respectively. Summer (April, May, June and July) residence per cent population of steppe eagle for years 2015 and 2016 is depicted in fig. 5. The greater spotted eagle was not evidenced during summer months of both the years. Fig. 6 depicts the comparison of environmental temperature and humidity of summer months of year 2015 and 2016. Summer months of 2016 exhibited higher THI values than year 2015.

Fig.5: Steppe eagle population (%) in summer monthsat Jorbeer Conservation Reserve, Bikaner, Rajasthan, India

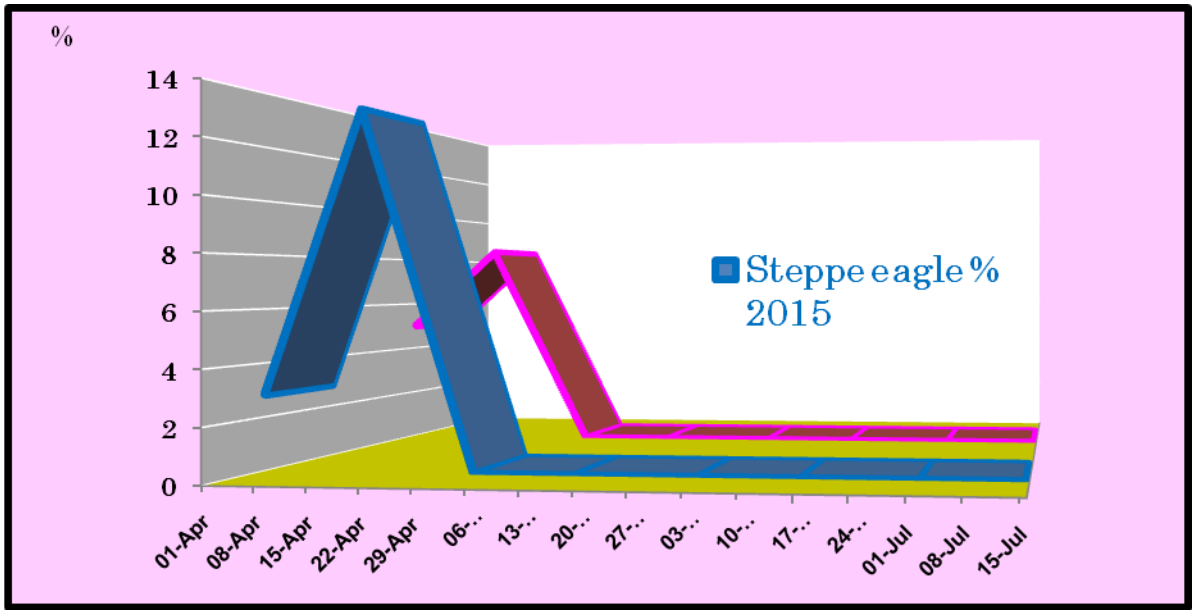
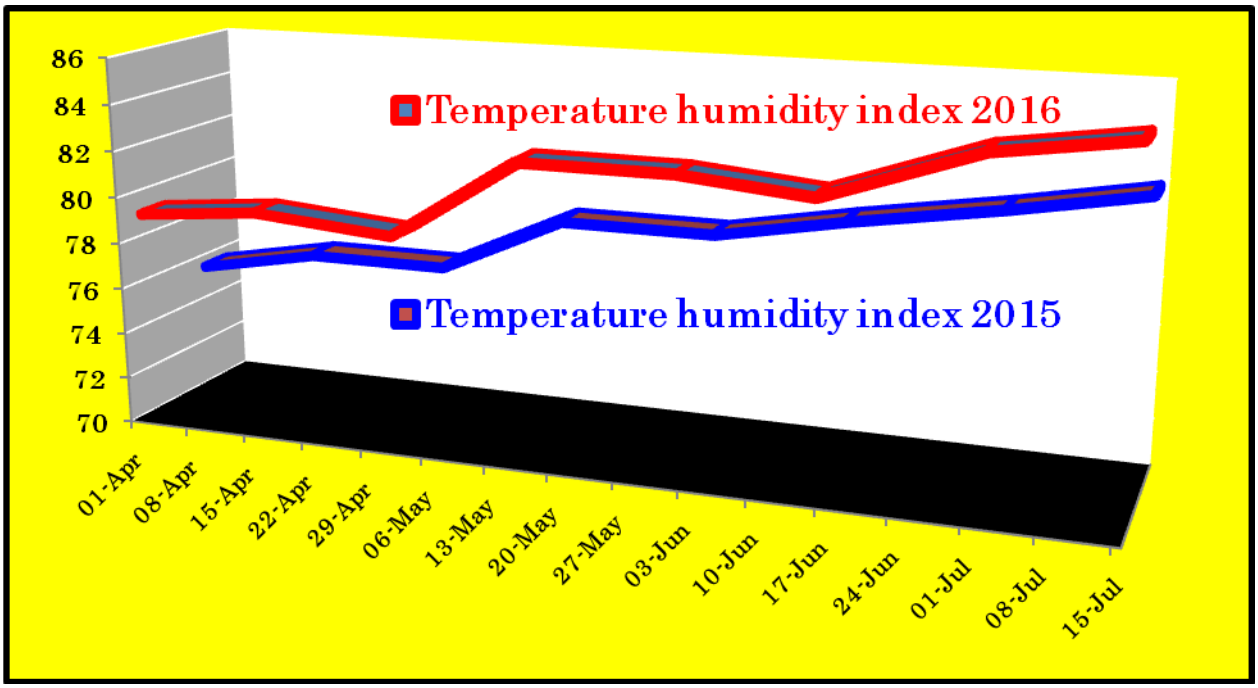


Fig. 6: Comparison of summer environmental correlates for year 2015 and 2016 at JorbeerConservation Reserve, Bikaner , Rajasthan, India



Eagle population (%) with maximum environmental temperatures (ºC) at JCRBRI is depicted in fig.7. Residential population of eagles was dependent upon environmental temperature. When maximum environmental temperature decreased comparatively the per cent of eagles staying at JCRBRI increased. Eagle population (%) with minimum environmental temperatures (ºC) at JCRBRI is depicted in fig.8. Migrant population of eagles was dependent upon environmental temperature. When minimum environmental temperature decreased during winter months the per cent of eagles staying at JCRBRI increased.Fig.9.depicts overall picture of eagles' residential period at JCRBRI with months and THI values. Steppe eagle stayed from November to April and greater spotted eagle from November to February only. Fig.10. exhibits maximum THI value threshold of eagles' at JCRBRI. It was 79.5 for steppe eagle and 72.5 for greater spotted eagle.Assessment of environmental elements of residential periods of both the eagles made a point clear that maximum THI value threshold of greater spotted eagle was less than steppe eagle. This could be the reason for the low number of greater spotted eagle in the area. Appraisal of per cent of eagles present in a particular environmental temperature is important to study thermoregulatory mechanisms of eagles. Higher per cent (75-100%) of eagles strictly showed a winter migratory.

Fig.7: Comparison of eagle population (%) with maximum environmental temperatures (^{0}C) at Jorbeer Conservation Reserve, Bikaner , Rajasthan, India

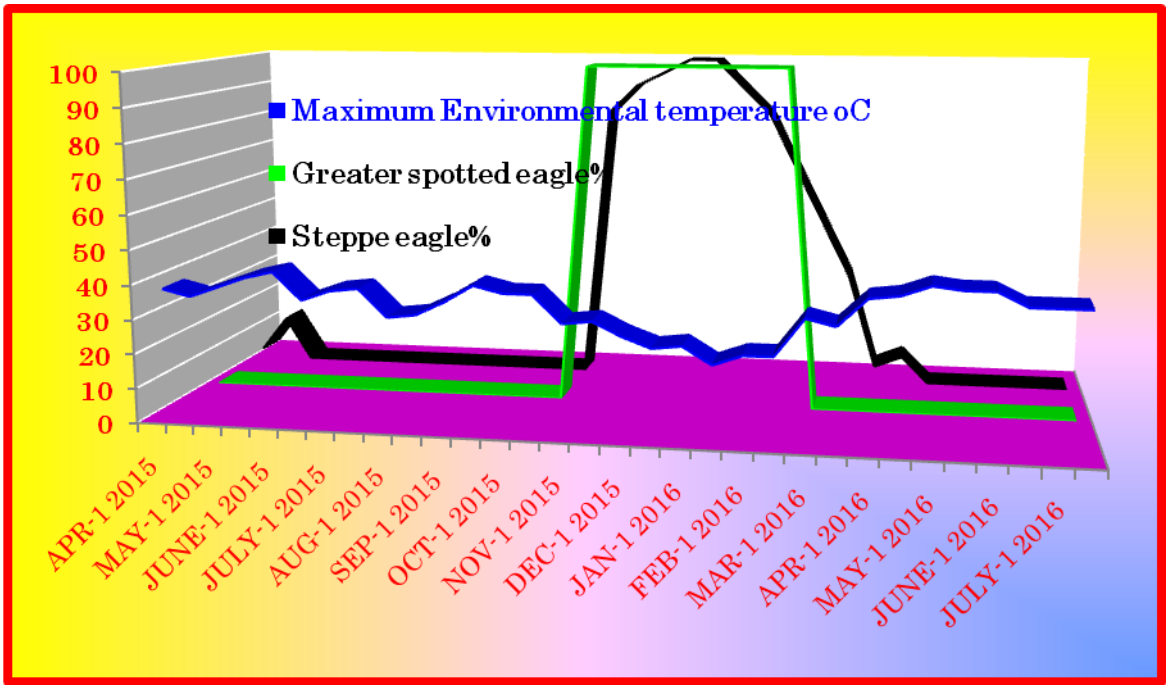


Fig.8: Comparison of eagle population (%) with minimum environmental temperatures (^{0}C) at Jorbeer Conservation Reserve, Bikaner , Rajasthan, India

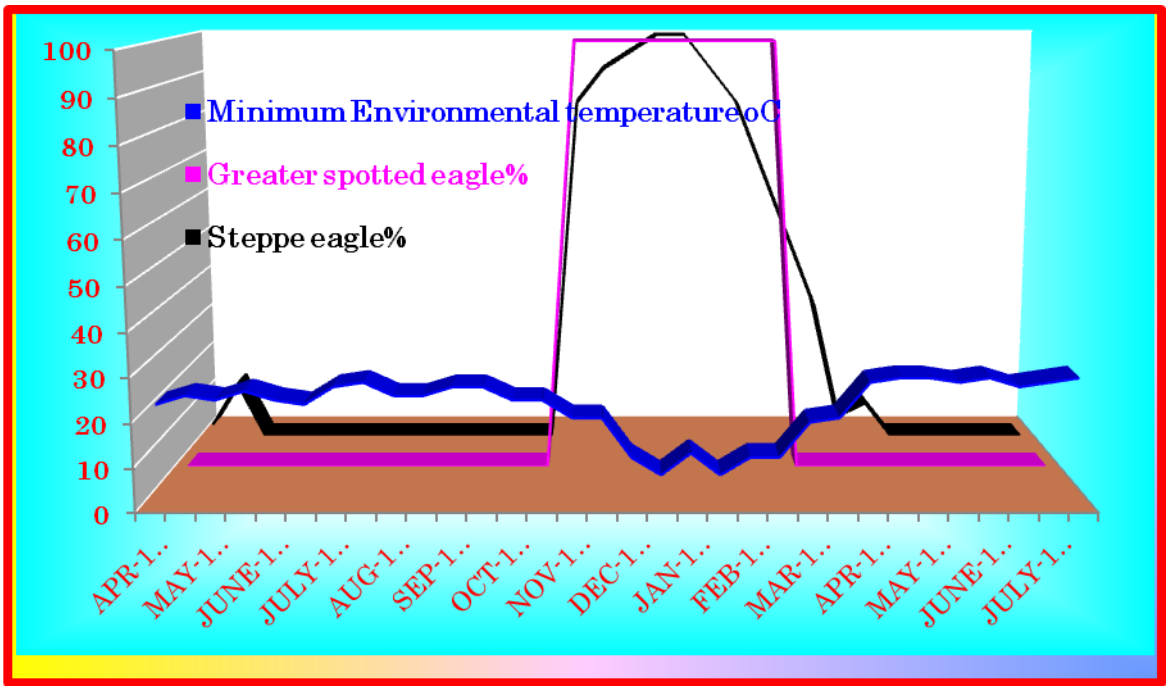
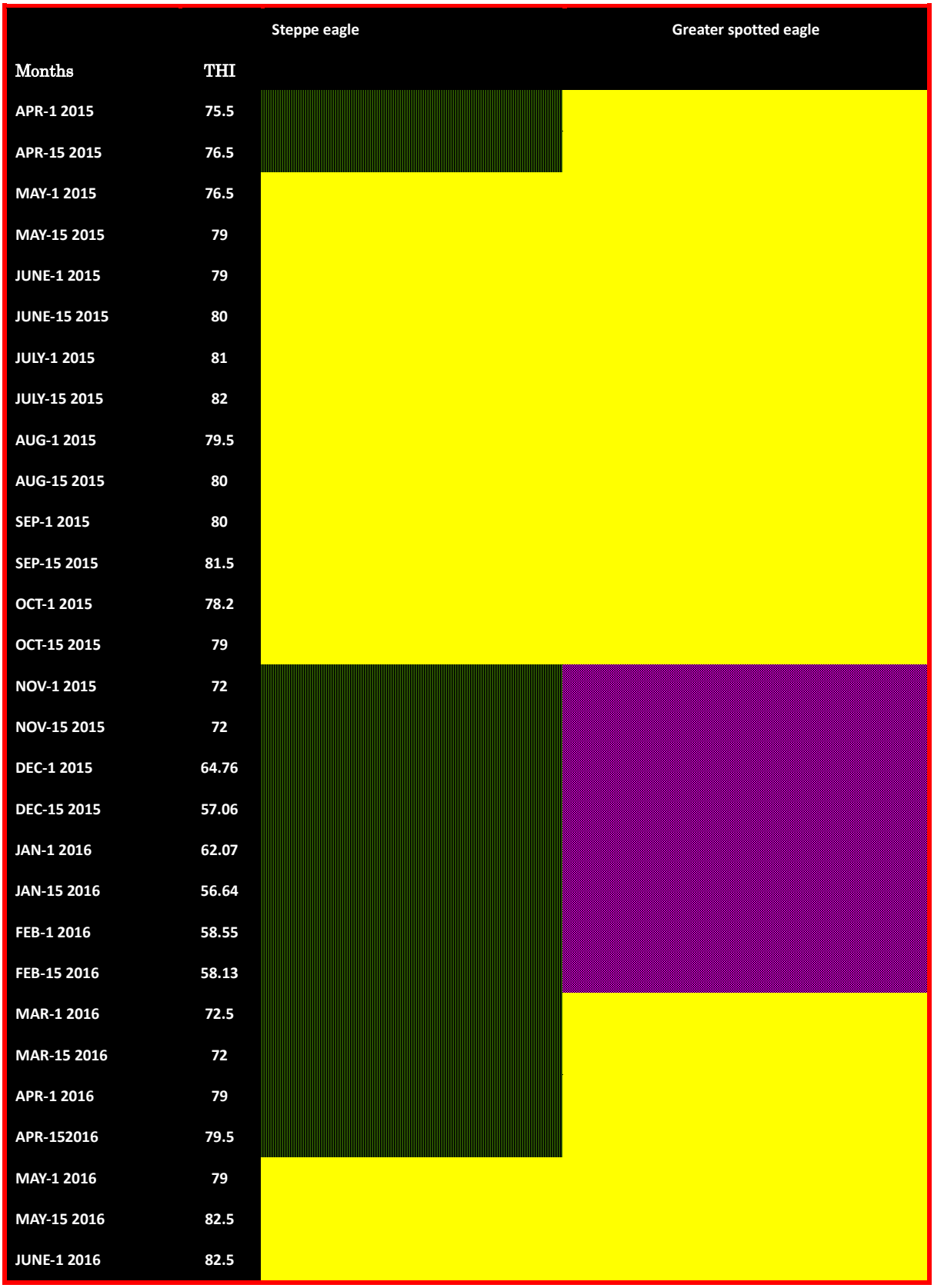
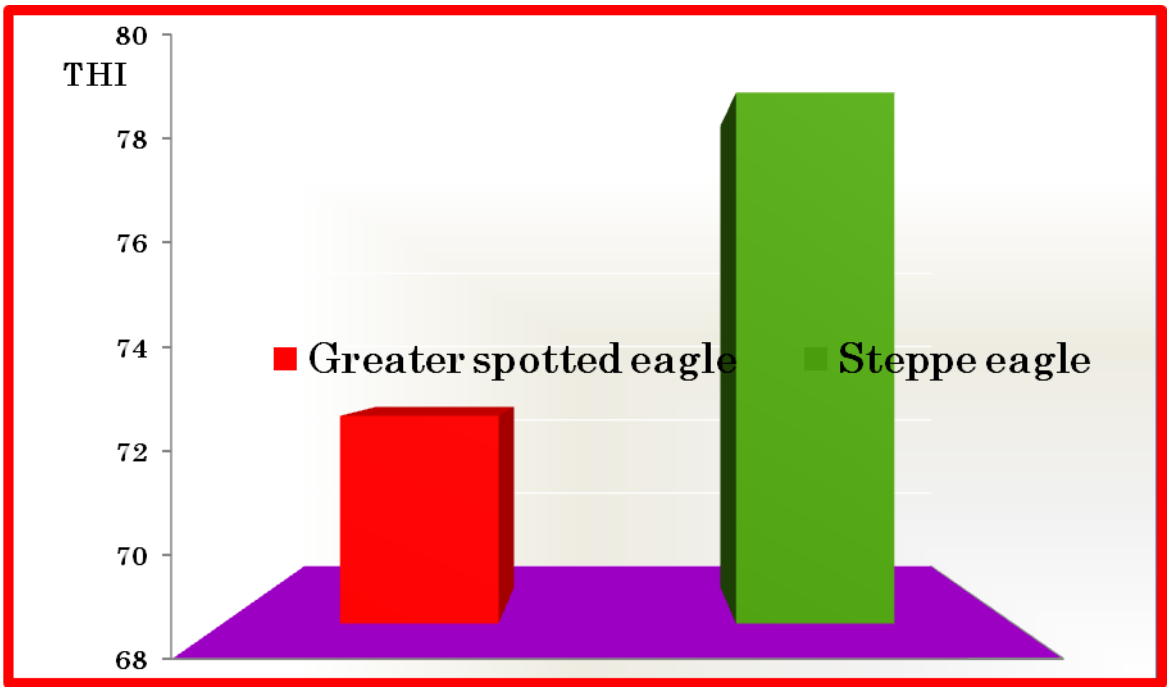


Fig. 9: Overall picture of eagles' residential period at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India with months and THI values



JUNE-15 2016	82
JULY-1 2016	84.2
JULY-15 2016	85

Fig.10.: Maximum THI value threshold of eagles' at Jorbeer Conservation Reserve, Bikaner, Rajasthan, India



pattern at JCRBRI from November to February when THI was 72 or low and minimum environmental temperature was varied from 6 to 19 ^{0}C. Steppe eagle was not observed from May to October, 2015 when THI varied from 76.5 to 82, and from May to July, 2016 when THI varied from 79 to 85. Greater spotted eagle was seen only during November to February months when THI was either 72 or lower.Concern about the protected areas of migratory eagles regarding the impending impact of environmental changes is imperative to execute additional management strategies. To accomplish the migratory journeys, eagles competently maneuver several obstacles coupled with hostile environment. Hostile environments bring about changes in migration of eagles from around the world in numerous ways. Many a times they may be awful for several species. As a result migrants require synchronized efforts to maintain conserves [6]. Temperature humidity index values are used to indicate stress. Soothe precinct is regarded when THI is less than 70. From 70 to 75, alert condition is considered where heat stress lessening efforts are initiated by the body. Peril may occur to physiological mechanisms from 76–81 [7]. Environmental impediments include

imperative concern over survival and future reproductive strategies.Therefore, migrants have developed physiological tactics to resist hurdles coming in the way of migration [8]. Pattern of upshot of the endeavor reflected that environment has huge induction on the migratory behaviour of eagles. Sixteen months data of the migratory eagles reaching to JCRBRI were used to analyse for their arrival, residential and reflying periods in response to environmental correlates of arid tracts.Upshot suggest that variations in environmental correlates influenced variation in migration pattern of eagles. Scientists [9] have proposed that migrants have to muddle through the environmental challenges in dissimilar ecologies besides boundless restrictions imposed by human and other type of interferences.

4. CONCLUSION

The date wise recording of number of steppe eagle and greater spotted eagle in addition to real-time recording of environmental temperature and humidity are important tools for monitoring eagle traffic in the region.Upshot of the endeavor helped to understand the absence of eagles in summer months during study periods. Steppe eagle stayed from November to April and greater spotted eagle from November to February only. Maximum THI value threshold of steppe eagle was 79.5 and 72.5 of greater spotted eagle. Higher per cent (75-100%) of eagles strictly showed a winter migratory pattern at JCRBRI from November to February when THI was 72 or low and minimum environmental temperature varied from 6 to19 ^{0}C.It can be deduced that greater spotted eagle was a winter migrant in strict sense. Steppe eagle was also observed during March and April months and had a higher THI value threshold. It can be deciphered that eagles have realization in finding out feeding tactics along with suitable environment for sheltering. The endeavor will help in understanding the ins and outs of eagle's migratory behaviour and changes in environmental elements

CONFLICT OF INTEREST

The authors declare that no competing financial interests exist.

REFERENCES

1. Wright KR (2016). Count trends for migratory Bald Eagles reveal differences between two populations at a spring site along the Lake Ontario shoreline. Peer Journal 17;4:e1986. doi: 10.7717/peerj.1986. eCollection 2016.
2. Simons TR, Moore FR, Gauthreaux SA. (2004). Mist netting trans-gulf migrants at coastal stopover sites: The influence of spatial and temporal variability on capture data. Studies in Avian Biology, 29:135–143.

3. Taylor GK, Reynolds KV, Thomas AL.(2016).Soaring energetics and glide performance in a moving atmosphere.Philosophical transactions of the Royal Society of London B. Biological Science, 26;371(1704).
4. Leppert LL, Layman S, Bragin EA, Katzner T.(2004).Survey for hemoparasites in imperial eagles (Aquila heliaca), steppe eagles (Aquila nipalensis), and white-tailed sea eagles (Haliaeetusalbicilla) from Kazakhstan.Journal of wildlife diseases, 40(2):316-319.
5. Gantner V, Mijic P, Kuterovac K, Solic D, Gantner R (2011).Temperature-humidity index values and their significance. on the daily production of dairy cattle. *Mljekarstvo*,61(1) :56-63.
6. Usman M, Farooq M. Migratory birds need coordinated protection.(2016). Science,26;351(6276):926-927
7. Xin H , Harmon J D. (1998). Temperature and humidity stress index for laying hens. In: Livestock industry facilities and environment: Heat stress indices for livestock, agriculture and environment extension publications. Book 163, Iowa State University.
8. Kataria A, Kataria N, Kumawat RN, GahlotAK(2016).Temperature humidity index *vis-à-vis* black kite (*milvusmigrans*) population and migration pattern in arid tracts in India.European Journal of Environmental Ecology, 3(2):69-74.
9. Cortés-Avizanda A, Almaraz P, Carrete M, Sánchez-Zapata JA, Delgado A, Hiraldo F, Donázar JA. (2011). Spatial heterogeneity in resource distribution promotes facultative sociality in two trans-Saharan migratory birds. PLoS One, 6(6):e21016.