Final Report

Assessment of the Population of White-naped Tit (*Parus nuchalis*) and its Thorn Forest Habitat in Southern Aravalli Hills, Rajasthan, India.

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Introduction:

White-naped Tit (*Parus nuchalis*) is a black and white colored bird that is most popularly known as Pied Tit. This 13 cm black and white bird is highly specific to its thorn forest. Earlier records show its vast presence in thorn forest of India especially in Rajasthan and Gujarat and a small



population in Andhra Pradesh- Karnataka border. Recent developmental activities, increased human population and increased dependency on forest resulted in shrinking of forest and consequently fragmentation of its habitat that ultimately resulted in decrease in population and local disappearance of various floral and faunal species.

Keeping all this in mind, a study was designed to carry out a proper assessment of its population,

habitat, threats and experiment the use of nest boxes as part of conservation measure in southern part of Aravalli hills. Aravalli hill is one of the oldest mountain range in the world, with its diverse habitats, is considered as an abode for assemblage of various endemic and threatened floral and faunal species. Assessment of the population of White-naped Tit (*Parus nuchalis*) and its thorn forest habitat involved appraisal of population of White-naped Tit in its prime habitat along with the mapping of the thorn forest, and assess the threats including competition for nesting to White-naped Tit species from other faunal species. The nesting competition was studied through provision of 50 nest boxes placed in its habitat. In this report, population and distribution of White-naped Tit, habitat use and use of artificial nest boxes by this species has been discussed in detail.

Methodology:

Area search or perambulation method was used to assess the approximate or minimum population of the bird species. On sighting a bird, the number of birds and the direction in which they were moving was noted. For each sighting of the bird GPS readings was recorded. Other vegetation data and habitat variables such as tree species where bird was seen, height & %canopy of the tree, tree density and most preferable habitat, prevailing threats (cutting, lopping, grazing, browsing & tourism) in its habitat were also collected at each location the birds were sighted. Further, GPS locations were taken in all the thorn forests that were survey for the birds irrespective of whether the birds were sighted or not. All these information were used to prepare the bird distribution and thorn forest distribution maps.

Nesting observation was done through rigorous monitoring of nest for which 50 wooden nest boxes were installed in natural habitat of the species during its breeding season. Added, within the area where the nest boxes were provided, presences of all natural holes were also assessed.

Above all mapping of potential thorn forest in Southern Aravalli hills as habitat for White-naped Tit was the prime concern.

Images of Thorn Forest in Pre & Post Monsoon Season



Images of Existing Threats







Images of Field Data Collection:



Study Location:

Study location was southern part of Aravalli hills comprises of Udaipur, Pali, Rajsamand and Sirohi district in Rajasthan and Banaskantha, Mehsana districts in Gujarat. This entire tract covers a significant amount of tropical thorn forest either in patches or interspersed with dry deciduous forest. Aravalli hill range in Rajasthan is mostly covered by dry deciduous forest with moist deciduous forest found along the nullahs, while huge swathe of tropical thorn forest is found in lower reaches mostly adjacent to human habitation or agriculture or farmlands. The distribution of thorn forest in Southern Aravallis is shown in the map (**Map 1**).

The nest boxes for this study were placed in thorn forest of the Mandigarh block near Rajpura village of Pali district and thorn forest of Banki area in Udaipur district of Rajasthan.



Results and Discussion:

1. Population Survey

On the whole in the southern Aravallis hills 43 patches of thorn forest (36 in Rajasthan and seven in Northern part of Gujarat) were surveyed and the birds were sighted in 20 forests in southern Rajasthan and four in North Gujarat. In total 214 birds were recorded in the southern Aravallis of which 122 individual were seen in southern Rajasthan and 92 individuals were documented in northern part of Gujarat (**Table 1**).

Area	No. of Thorn Forest (Sites)		No. of Birds Recorded
	Surveyed	Where Birds Sighted	
Southern Rajasthan	36	20	122
North Gujarat	7	4	92
Total	43	24	214

Table 1: Thorn Forest Surve	ved and No. of White-na	aped Tits Recorded duri	ing this Study
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2. Habitat Use

The habitat use and factors influencing the presences of White-naped Tit in the Thorn Forest was done using principal Component Analysis (PCA). The uses of different factors in the thorn forest are described below. For this analysis 52 sightings, which resulted in recording of 120 individuals was used. Where ever birds were heard and seen in flight i.e., flew from the site before spotting were not included for habitat use as information on all variables could not be collected. The result of PCA showed that four habitat features *viz.* mean height of trees, state of the forest, numbers of layers of forest and percent of cutting influenced the presence of the bird. Among these percent cutting had a negative influence while three had the positive influence (**Map 3**).

a. Thorn Forest Habitat Use: Based on the type of thorn forest in which the birds were sighted, highly used habitat was derived. More White-naped Tit were seen in dense Acacia thorn forest followed by *A. senegal* mixed thorn forest, both with tree and shrub layers, with *A. totilis* dominated semi-dense TTF being the least used (Figure 1). Records show that earlier *Acacia senegal* and *A. leucophloea* were dominant in Aravalli hills which, later was replaced by *A. tortilis*. The replacement of species occurred mainly in the southern part of Aravalli hills of Gujarat region. The Aravalli hills in the southern Rajasthan still harbors large stretch of *Acacia senegal* and hence has a comparatively large population of White-naped Tit.



b. Tree Species Use: As evident that *Acacia senegal* was the dominant forest habitat in Southern Aravalli hills, it is also reflected in tree species use. Most of the individuals (66%) were seen exploring or feeding on *Acacia senegal* species (Figure 2).



c. Percent Canopy Cover Use: Based on the number of individuals seen in different % canopy cover, it was evident that this species were found to occur at sites with more canopy cover. Maximum use was found to be spots with 51-60% canopy cover (**Figure 3**), where the birds were seen exploring and foraging.



d. Use of different Tree Density Classes: Maximum number of White-naped Tits used dense Acacia thorn forest, but sites with tree density of >10 – 40 trees/ha that was evaluated using 20m radius plots. These sites usually had two layers (tree and shrub) that probably provided more foraging habitat. Further, it was also found that wherever the density of trees was more that is above 40/ha, the canopy and size of individual trees were comparatively small than large sized trees with larger canopy in the sites with low density of trees, other than cutting. This explains why White-naped Tit used more sites with lower density of trees (Figure 4). Added the high tree density spots were mostly of *Anogeissus pendula* that was planted very closely, a common feature in Aravalli hills and these were least preferred by this endemic species.



e. Use of different Height Classes of Trees: Birds are very specific to height of the trees and most of the sightings were between 2-5m height, with maximum of 42% of the birds found in 4-5m height class (**Figure 5**). This clearly indicates that any threat in terms of cutting and lopping would affect the very existence of the bird as well as the tropical thorn forest habitat in Southern Aravallis.



f. Sightings of White-naped Tit in Southern Aravalli Hills: Most of the sighting of this bird species was from Kumbhalgarh Wildlife Sanctuary (KWLS) because this sanctuary harbors a fairly large tract of thorn forest at the foothills of Aravallis, with fewer disturbances compared to other sites (Figure 6 & Map 2).





Map 2: Location of White-naped Tit in the Thorn Forest of Southern Aravalli Hills

Map (Map 2) also shows that most of the sightings of this species were in Kumbhalgarh WLS (along the boundary of Pali and Rajsamand Districts) and Udaipur District of Rajasthan. g. Use of different state of Habitat: Presence of more individuals in forests that is contiguous with other patches of forest clearly depict that White-naped Tit prefers to be in undisturbed and contiguous habitat or larger patch of thorn forest. However, birds were also seen in narrow patches only if the disturbance was low (Figure 7). The map clearly shows that most of the birds were sighted in area with low disturbance (Map 3).





Map 3: Location of White-naped Tit in Different Disturbance Classes

Above map shows that thorn forest habitat is facing tremendous pressure that has led to fragmentation, patchiness and high degradation. These pressures were from various irreversible anthropogenic activities like marble mining, fuel and timber cutting and continuous lopping, uncontrolled grazing and some places encroachments for agriculture. These types of threats cannot be repaired and would lead to disappearance the thorn forest and ultimately local extinction of White-naped Tit in this hill range, which is the major distribution range.

Experimental Conservation Action: White-naped Tit Nesting Observation using Artificial Nest Boxes

One of the objectives of this study was to find out whether White-naped Tit accepts artificial nest boxes in addition to finding out the competitors for nest by using artificial nest boxes in its territory, which were with two different hole sizes (3.6 cm diameter & >3.6cm diameter). We had put up 50 nest boxes at different place in Kumbhalgarh WLS and Banki forest division in Udaipur in the Aravalli hills of south Rajasthan. The sites for setting up of the nest boxes were selected after intensive following of different pairs of White-naped Tit, which provided information on its area of use. The nest boxes were placed within the area of use of different pairs to make the birds get habituated to the nest boxes. However, before putting up the nest boxes, we looked for the presence of natural holes in that particular site and surprisingly found only 14 natural holes present in 2 sq.km of area in which the boxes were set up. Of these natural holes, four big sized holes were occupied by Rose-ring Parakeet (*Psittacula krameri*) (two holes), Plum-headed



Parakeet (*Psittacula cyanocephala*) (one hole), and Common Myna (*Acridotheres tristis*) (one hole), six medium sized holes were taken up by Brahminy Starling (*Sturnus pagodarum*) (three holes), Five-striped Palm Squirrel (*Funambulus penneti*) (two hole) and Indian Bush Rat (*Golunda ellioti*) (one hole), while rest of the four small sized holes were occupied by a species of large black ant (two holes), small honey bee (one hole)and Long tailed Tree Mouse (*Vandeleuria oleracea*)(one hole). Ideally the White-naped Tit prefers the medium sized holes for nesting.

In total eight pair of White-naped Tit explored 38 boxes, but only seven pairs constructed nest in seven different nest boxes. Among these seven boxes, in five of the boxes four fledglings had come out, while in



the remaining two, three fledglings had come out. Thus showing that these birds readily take ups artificial nest boxes and breed successfully. One bird nested twice with different female using different nest boxes. Based on one observation on nesting of this species it was evident that this bird starts breeding from June to beginning of October (n= 8). Both male and female takes part in the nest construction. Nesting material used was live and dead roots and blades of grass and other ground

vegetation. Sometimes three individuals were seen taking part in this process and it could be a helper (Male/Female) bird of previous year's brood. This helper bird is seen at the time of parental care also, mainly during feeding the chicks, but it was only occasional and rare. Parental care was high in this bird species as both male and female birds were seen actively feeding its progeny i.e. box visitation time was 14-17 times/hour and most of the time feeding material was caterpillar and worm protein needed for proper growth of their juveniles.

The number of days taken by White-naped Tit is as follows:

- Nest construction: 5-7 days
- **Clutch size:** 4-6 (artificial hole i.e. Nest Boxes)



- **Incubation time:** c.12 days
- Fledglings comes out: after 12-14 days
- Parents feed fledglings outside: 6-7 days



Out of the 50 nest boxes only eight were used by White-naped Tit whereas rest of the boxes were used by other competitor species i.e. Fivestripped Palm Squirrel (*Funambulus pennantii*), Indian Bush Rat (*Golunda ellioti*), Long-tailed Tree Mouse, an big black ant species (Unidentified), Brahminy Starling (*Sturnus pagodarum*) and Honey bee (*Apis* spp.). After monitoring the presence of squirrel, bush rat and tree mouse in

most of the nest boxes, we decided to modify the nest boxes. We modified all nest boxes by covering them with a thin aluminum sheet around the box (**see pictures**) setting the hole size as 3.6 cm diameter. Finally we have placed them in bird's territory and monitoring is in the progress and recently seen two pair exploring these modified nest boxes. One pair has already started constructing nest (recent update from the field). Most important feature is the thin aluminum sheet has served as barrier to squirrels and rats as they are not able to get hold on the nest box and thus our experiment to keep away these two species is working.

Involvement of Local Community: Another main objective of this study was the involvement of local community in all the discussions and conservation action. To fulfill this we had employed two youths from the local community, trained them in monitoring the birds and nest boxes, awareness creation in local language and other assessment process.



Recommendation for future conservation: There are few points that can be taken into consideration for proper conservation and management of this species and its habitat.

• Develop area and site specific conservation plan such as catering the needs of the local community who are dependent on the thorn forest through restoration and plantation of the necessary species within their village environs mainly the common lands and along the fringes of the forest.

Carry out soil and moisture conservation work in the village environs and also in the forest adjoining the village that would improve the local conditions and potential of their agricultural lands as most of these forest and hills serve as watersheds to the local communities living below.

Dialogue with local communities:

- a. Awareness program on regular basis on the significance of the thorn forest, White-naped Tit and other wildlife in the area along with training on simple systems like rotation grazing, sustainable extraction of resources and so on in the villages close to all potential White-naped Tit habitat the tropical thorn forest is very important.
- b. Employment for local community for e.g. recruitment of field assistant from local community in all research activities being taken up in the area, recruit as fire and cattle guards.



Dialogue with Forest Department:

- ✓ Provision of artificial nest boxes & regular monitoring of them.
- ✓ Regular and systematic monitoring of the White-naped Tit population in the thorn forest of all the
- PAs and Reserved forests in Southern Aravallis
- ✓ Developing other option for fuel-wood- to reduce cutting pressure Develop fuel-wood plots
- Regulating and monitoring migratory livestock- to reduce grazing/browsing pressure & Develop Fodder Plot.
- ✓ Monitoring for stopping encroachment for agriculture,
- ✓ Restoration of thorn forest with thorny species and not other dry deciduous species.
- ✓ Creation of small corridors between patches of TTF.



• **Research & Studies:** An in depth study on the ecology of this vulnerable and endemic Whitenaped Tit is of high necessity, as it would provide information on the social organization of the species outside breeding season and also shed light on the breeding ecology of the species, which needs to be done through marking the individuals both adults and fledging. This would provide data on whether and also to confirm that some individual breed twice in the same breeding season and also to know who are the helpers. Further, marking the individuals would provide information on the area needed for a bird during the non breeding season and also the area needed by a pair during breeding season.