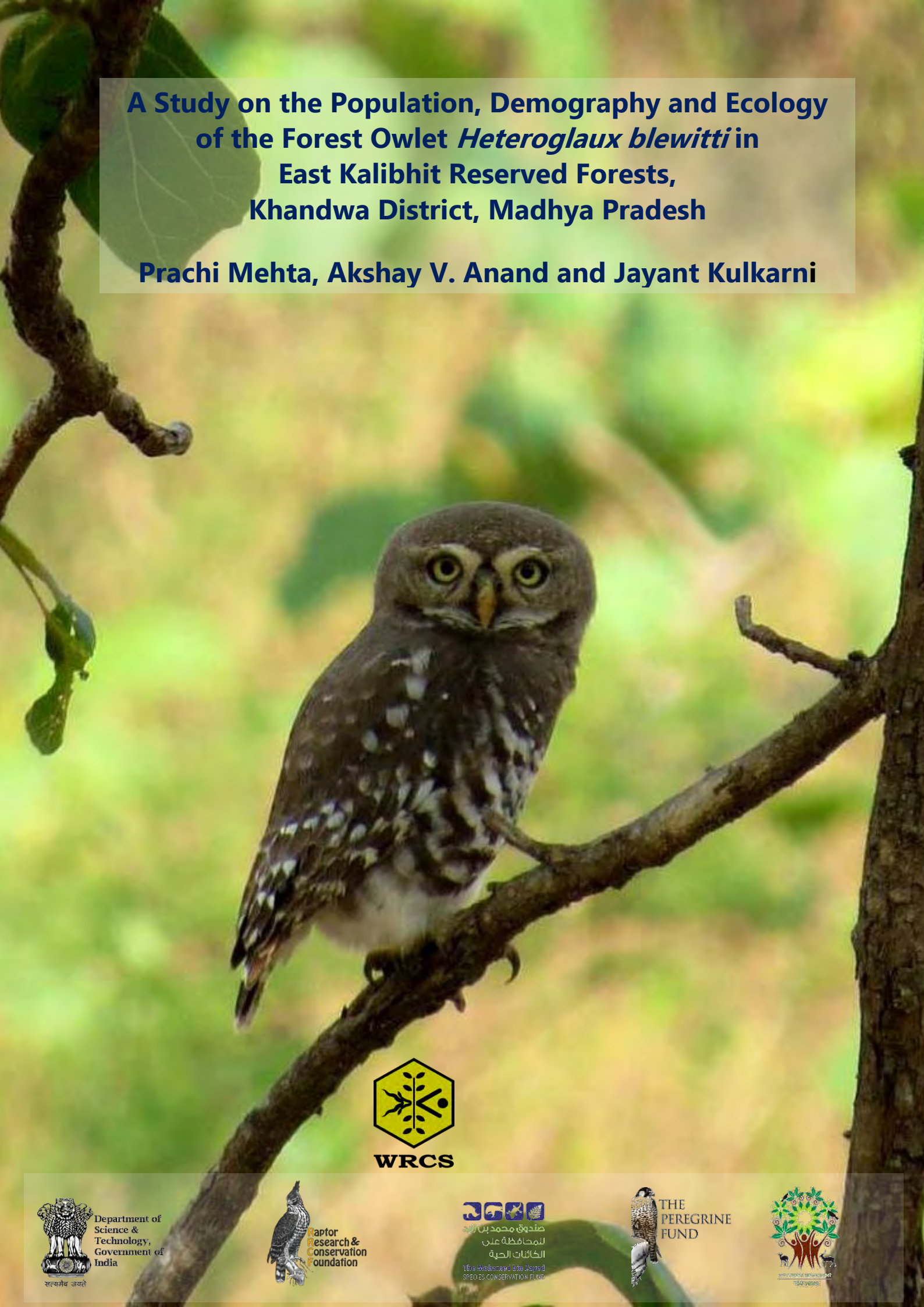
# A Study on the Population, Demography and Ecology of the Forest Owlet *Heteroglaux blewitti* in East Kalibhit Reserved Forests, Khandwa District, Madhya Pradesh

**Prachi Mehta, Akshay V. Anand and Jayant Kulkarni**



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*The Authors*

December 2017

# Executive Summary

The Forest Owlet *Heteroglaux blewitti* is a small sized diurnal owl, endemic to India. Owing to its small and isolated population, it was placed in Critically Endangered category of IUCN till recently (Birdlife International 2017) and is listed under Schedule I list of Indian Wildlife Protection Act.

Wildlife Research and Conservation Society (WRCS) initiated a long term study on the Ecology of Forest Owlet in East Kalibhit Range of Khandwa District in Madhya Pradesh. The field study was carried out from December 2012 to April 2017.

The study was supported by Department of Science and Technology (DST), New Delhi and Raptor Research and Conservation Foundation (RRCF), Mumbai. A small grant was also received from the Mohamed Bin Zayed (MBZ) Species Conservation Fund, UAE. The Peregine Fund, USA donated radio tags, antenna and receiver for the Forest Owlet study.

Although several surveys and two ecological studies have been carried out on the Forest Owlet in the country, there is a lot that remains to be understood about the spatial and ecological requirement of the species. Forests of Khandwa Divisions are managed forests where regular logging operations are carried out. The Reserved Forests are also used by the local communities for collecting fuel wood, grazing their cattle and for collecting minor forest produce. There is considerable pressure on the habitat due to illegal tree cutting by the villagers.

Existence of the Forest Owlet in these forests for all these years indicates that Forest Owlet is capable of surviving in managed forests. However the impact of forestry operations on the Forest Owlet is not known. It is important to understand why the species is rare, which factors are affecting its survivability and what interventions are required for its long-term conservation in the country

The long -term goal of this project is to understand various ecological, environmental and biotic factors that affect the presence of Forest Owlet in the study area. The study is planned in two phase at the chosen site. During the first phase, we shall carry out an ecological study on the Forest Owlet and in the second phase implement a monitoring and conservation program. This report is based on the findings of our study in the first phase.

In Khandwa District, we selected East Kalibhit Range as an intensive study area. After a rapid survey of the area, we selected a compact area of about 100 $km^2$ to monitor the presence of Forest Owlet. The selected area was overlaid with 2 km x 2km survey units (main grids) Each 2 km unit was further divided in to sixteen 25 ha or 500 m x 500 m survey stations (sub-grids). Each survey unit had a geo-referenced central co-ordinate.

Totally 25 survey units were selected to monitor the forest owlet in the study area. Of these, 18 survey units were in a compact cluster and were selected because it had presence of forest owlet in the area. Additional 7 survey units were selected to assess the impacts of timber harvesting on the forest owlets.

Forest Owlet habitat assessment was carried in a grid-wise manner in each 500 x 500 m grid of the study area. Quadrats of size 20 x 20 m were laid at the centre of each grid. The vegetation was divided in three strata: tree, shrub and ground cover. The study was carried out in 434 subgrids.

In East Kailbhit, the Forest Owlet occupied sites were mostly in plain area with low elevation range. Also had low to medium slope and narrow elevation range. It occupied forests with trees with medium GBH and tree height. The Forest Owlet occupied areas with good forest cover and close to agricultural fields.

We have color-banded 50 Forest Owlets in the study area. This included 23 females, 19 males and 8 juveniles. The total banded birds included 14 pairs of Forest Owlets. Apart from the banded birds, we observed 7 more Forest Owlets in the study area that were un-banded. As per our banding records, the study area supports minimum 57 Forest Owlets.

Color-banding was found to be most useful in studying movement, territoriality and breeding success of Forest Owlet in the study area. Our findings indicate that Forest Owlets are territorial during their breeding season. The same nest continues to be used by the same pair in the next breeding season. Female Forest Owlets are more localized than the males. Forest Owlets have localised movement and we found a few banded individuals who moved from 2 to 6 km within the study area.

We studied the diet of Forest Owlet by examining the regurgitated pellets. During the study, we have collected 526 pellets of the Forest Owlet and have separated 1436 prey items from them. We compared the diet of Forest Owlet with two co-occurring species in the area, namely, the Spotted Owlet and the Jungle Owlet. The results of the first year diet analysis indicate that the Forest Owlet feeds mainly on small mammals while the other two owls feed primarily on invertebrates. The Forest and Spotted Owlet preyed on small to large sized mammalian prey while Jungle Owlet fed on smallest sized prey. The three owls appear to be able to co-exist mainly due to differences in their foraging time, hunting mode and prey size consumed.

We could locate 15 nests of Forest Owlets in the study area. We could detect totally 17 nests of Forest Owlet during the study. All nests were not used each year by the Forest Owlet. In 2013-14, we observed maximum number of pairs (11) using the nest. In subsequent years there were 4 to 6 breeding pairs in the area.

Forest Owlets did not show specific preference for tree species for nesting. However maximum (41%) nests were found on *Garuga pinnata,* followed by *Tectona grandis* and *Terminalia tomentosa* .The mean nest tree height was 15 m, mean nest GBH was 137 cm, mean nest height was 7 m, and mean GBH at cavity was 92 cm.

Each year we could find 2 to 4 juveniles in the study area. Juveniles dispersed from the nesting site. In 2014-15, we observed one of the banded juveniles in the area but was found at a distance of 6 km from the nest site. Overall, breeding success of Forest Owlet is low in the study area. One of the possible reasons for this could be the presence of natural predators in the forests. Cutting of large and mature trees may also be contributing to unavailability of suitable cavity for nesting for the Forest owlet.

We radio-tagged three Forest Owlets in the study area. This included 1 breeding male, 1 non-breeding male and I non-breeding female. This study was carried out for 4 months towards the end of the project. Through this study, we have developed some initial insights in the behaviour of the Forest Owlet. The movement pattern of a breeding male is different than a non-breeding female. Male had a home range of 800 m2 while the female had a home range of 600 m2.
The breeding male hunted only in the forest area while the female hunted in the crop field. All three radio-tagged bird were found to be perched mainly on teak trees for their activities. One

of the radio-tagged male was found to be predated by a bird of prey and the other bird is suspected to be predated too. The female was safe and the tag has been retrieved.

The Forest Owlets and its habitat is facing several challenges in East Kalibhit Reserved Forests. The forests are being managed for timber harvesting. While the tree felling was going on, the Forest Owlet pair did not nest in the area and in other places they were present after the felling had taken place. The tree felling, while being conservative, may be creating local disturbance for the owls. There is also considerable tree cutting pressure in the area. Local people cut trees for fuel wood as well as for house construction and other purpose. This type of tree cutting may be having serious impacts on the habitat and availability of suitable cavities for the Forest owlet. Forest Fires also cause a lot of damage to the habitat, especially when the juveniles are out of the nest. Fires also affect the prey availability in the area. The speeding vehicles plying on SH 46 causes many road kills of owls and other wildlife. Local people steal parakeet chicks for trade by cutting the nest trees. Although we did not get any proof of Forest Owlet in the area, there is a lot of interest in owl capture ad owl trade in the villages.

To address the above issues, we have engaged with the Forest Department at various levels. Based on our discussions with the senior Forest Officers of MP Forest Department, we could mark important roost and nest trees of Forest Owlet and other owls in the study area with a green paint so that the local people keep away from those trees. This experiment has been successful so far.
We have also suggested that the nesting trees of owls should be exempted from felling. The working plan officers have also agreed to reserve such trees for owls.

We have arranged two workshops for the field staff to generate awareness on types of owls found in the study area, their nests and their importance in ecosystem. Totally 160 field staff has participated in the owl conservation workshops.

We have engaged with the local communities of the area and tried to make them conservation partners. We have generated awareness on the importance of owls in controlling rodent in their farms and tried to convince them against the use of rodenticides.

We have established Self-help Groups (SHG) in two villages in the study area. Each group consists of 3 to 4 young women. We are promoting their products under a brand named “Athena”. Under Athena, the SHG ladies have been trained in making handicraft items based on owl theme. Athena groups are making tote bags, key chains, cushion covers and t-shirts made on owl shaped appliqués. WRCS is marketing the products and the proceeds of the sale are diverted towards the ladies as an incentive to protect the owls and their nests in their farms. One person has also been making owl shaped wooden items and earning income through WRCS. This initiative has become successful and will be carried on further to benefit the owls and the local farmers.

We have shared the findings of this study in scientific and public platform in various ways:

10 oral talks and 3 poster presentations in conferences and meetings

1 publication in a peer-reviewed International journal on raptors
1 publication in a peer-reviewed Indian ornithology Journal

A 200 page detailed technical manual on Prey Identification from Owl Pellets has been prepared through this project which describes techniques for pellet collection, pellet analysis, prey identification and prey quantification for all major taxa of owl prey. This is the first of its type of technical manual prepared in India.

2 field guides cum booklets on owls have been prepared for the field staff

2 popular articles on Owls have been published in magazines

We have submitted 8 quarterly progress reports and 2 annual reports

2 M.sc Students have worked for their M.sc dissertations on this project

Through this project, we have been able to train many students on field-based owl research. 13 students have been trained in various methods of field–based research on owls including occupancy survey, color-banding, radio-tagging and tracking, demography and breeding studies, pellet collection and habitat sampling. At the office, students have been trained in data analysis, pellet analysis, paper writing, poster making and presentation skills.

# Chapter One
# Background

## 1.1 An Introduction to the Forest Owlet

The Forest Owlet *Heteroglaux blewitti* is a small sized (23 cm) diurnal owl, endemic to India. Owing to its small and isolated population, it was placed in Critically Endangered category of IUCN till recently (Birdlife International 2017) and is listed under Schedule I list of Indian Wildlife Protection Act.

The Forest Owlet resembles the Spotted Owlet *Athene brama* in some ways, especially in its overall appearance and color but the markings are very different. The Forest Owlet is a heavier and thick-set bird compared to the Spotted Owlet. It has shorter wings, thicker legs and bigger talons than the Spotted Owlet. Forest Owlet has faintly spotted crown and almost plain back as opposed to the Spotted Owlet who has spotted crown and streaked back. The Forest Owlet has a short tail with white terminal band. Forest Owlet has distinct brown pectoral band which is broken and indistinct in the Spotted Owlet. The flanks are distinctly barred in the Forest Owlet while it is streaked in the Spotted Owlet. Forest Owlet has a clear white belly while the Spotted Owlet has spotted and streaked belly (Ali and Ripley 1987, Grimmet et al. Konig and Weick 2009, pers.obs.)

**Forest Owlet**

*Prachi Mehta/WRCS*

As per its present distribution, it is reported from twelve confirmed locations within Central and North-western India (Mehta et al. 2017).

## 1.2 Discovery of Forest Owlet in India

1872 - 1884

The Forest Owlet was described for the very first time in the Indian Ornithology by F. R. Blewitt a British Officer in 1872 and that's why it is also known as the Blewitt's owl. The This specimen bal History (AMNH), British Natural History Museum (BMNH), and National Museum of Natural History (USNM) (Rasmussen and Collar 1998) and there were chances that the species was overlooked in India. Armed with this fact, Rasmussen and Ben King set out on a month-long survey for the Forest Owlet from Orissa to Toranmal in North-Western Maharashtra. Towards the end of their survey they were successful in locating 2 individuals of the Forest Owlet near Toranmal in Maharahstra. Thus the Forest Owlet made a historic re-appearance in Indian Ornithology (Rasmussen and Collar 1998, King and Rasmussen 1998).

## 1.3 Reports of Forest Owlet from Various Locations following its Rediscovery

1999 - 2000

After the rediscovery, the Bombay Natural History Society (BNHS) carried out a survey in Chattisgarh, Odisha, Madhya Pradesh and Maharashtra. (Ishtiaq and Rahmani 2000).

Main findings of the survey were

- 4 Forest Owlets from from Khaknar Range, Burhanpur District Madhya Pradesh,
- 4 birds at Shahada Reserved Forests
- 6 Forest Owlets from Taloda, Nandurbar district, Maharashtra
- 1 Bird from Melghat Tiger Reserve in Maharashtra (Ishtiaq and Rahmani 2000).
- Forest Owlet was not detected from other surveyed areas.

### Survey in 5 States for the Forest Owlet by WRCS (Erstwhile Envirosearch)

2005- 2007

An intensive survey to determine the status and distribution of Forest Owlet was carried out across 5 states of India by WRCS team (Mehta et al. 2007, 2008). The survey reported 44 individuals of Forest Owlet, and one new location (and two new ranges within the district) of Forest Owlet in India, namely Khandwa District in Madhya Pradesh.

Main findings of the survey is as given below

- 3 Forest Owlets from East Kalibhit Range in Khandwa District
- 6 Forest Owlet from West Kalibhit Range in Khandwa District
- 9 Forest Owlets from Piplod Range in Khandwa District
- 6 Forest Owlets from Khaknar Range in Burhanpur District
- 20 Forest Owlets from Malur, Rangubeli, Semadoh, Hatru, Vairat and Dhargad area f Melghat Tiger Reserve
- The survey could not report the presence of Forest Owlet from Chhattisgarh, Odisha and Gujarat.

### Presence of Forest Owlet in Melghat Tiger Reserve, Maharashtra

1999

One Forest Owlet was reported from Chikalaam in Melghat (Ishtiaq and Rahmani 2000)

2002-03

Two birds were reported from Malur-Harisal in Melghat Tiger Reserve (Kasamabe et al. 2003)

2004
In June 2004, 79 Forest Owlets were reported from three sites in Melghat Tiger Reserve (Jathar and Rahmani 2004). No Forest Owlet was detected by the team in Van and Narnala Sanctuary.

2005
20 Forest Owlets were reported from Melghat Tiger Reserve from seven different locations (Mehta et al. 2008)

2014
A three month rapid survey in the east and west Melghat divisions was carried out to assess the presence of Forest Owlet. The survey was successful in reporting 4 individuals from Dharni Range (Mehta and Kulkarni 2014).

2016
A ten day survey was carried out to assess the presence of Forest Owlet in Chourakund Range in Melghat Forest. The survey reported 11 individuals from Chourakund Range (Mehta et al. 2016).

### Forest Owlet in Yawal Wildlife Sanctuary, Maharashtra

2000 - 2004
The BNHS team surveyed Yawal Wildlife Sanctuary in 2000 and 2004, but did not record the presence of Forest Owlet from Yawal (Ishtiaq and Rahmani 2000, Jathar and Rahmani 2004). In 2004, a pair of Forest Owlet was reported from Yawal Sanctuary (Chavan and Rithe 2009). The team reported that it could be a breeding population of Forest Owlet.
During the 5 state survey, we also surveyed Yawal Sanctuary but did not find the presence of Forest Owlet in Yawal (Mehta et al. 2007, 2008). In 2015, we surveyed Yawal once more for Forest Owlet but again failed to record presence of Forest Owlet (Mehta et al. 2017).

### Re-assessment of Presence of Forest Owlet in Central India

2011
Jathar and Patil surveyed Nandurbar district in Maharashtra and Khandwa and Burhanpur districts in Madhya Pradesh from where the presence of Forest Owlet was reported earlier (Ishtiaq and Rahmani 2000, Mehta et al. 2008).

Their survey reported the following:

- A pair of Forest Owlet in Toranmal Reserved Forest
- 6 individuals in Khaknar Range in Burhanpur District, Madhya Pradesh

Jathar and Patil (2011) could not find the Forest Owlet in any other ranges in Nandurbar district and in Khandwa district.

2015
From August 2015 to June 2016, WRCS carried out a survey of Forest Owlet in Nandurbar District, Yawal Sanctuary and Tansa Sanctuary. Through this survey, we reported, for the first time, Forest Owlet presence from Navapur and Chinchpada Range of Nandurbar District, (Mehta et al. 2017).

The findings of the survey is as given:

- 4 birds in Toranmal Range
- 6 birds in Taloda Range
- 13 Birds in Navapur Range
- 3 Birds in Chinchpada Range

In Tansa Sanctuary, we found the Forest Owlet well distributed in the forested area of Tansa forests (Mehta et al. 2017).

- 3 birds in Tansa Range
- 7 birds in Vaitarana Range
- 3 birds in Khardi Range
- 6 birds in Parli Range
- We did not find the Forest Owlet in Yawal Sanctuary.

### Forest Owlet in Betul District, Madhya Pradesh

2014
In December 2014, while surveying West Betul Forests for presence of Forest Owlet, we located one individual in the area (Mehta et al. 2015).

### Forest Owlet in Tansa Wildlife Sanctuary, Palghar District, Maharashtra

2014
In October 2014, a pair of Forest Owlet was reported from Tansa Wildlife Sanctuary, Palghat District in Western Ghats of Maharashtra (Laad and Dagale 2015). This was one of the most unexpected record of the Forest Owlet as so far it has been reported from Central India and this was the first record of its presence from Western Ghats.

### Forest Owlet in Dangs, Navasari and Valsad districts in Gujarat

2015
In November 2015, there was a first report of Forest Owlet from Purna Wildlife Sanctuary, Dangs District in Gujarat (Patel et al. 2015). This was the first record of its occurrence in Gujarat.

2016
In December 2016, a survey by the Gujarat team recorded presence of Forest Owlet from Navasari and Valsad districts of Gujarat (Patel et al. 2017).

### Forest Owlet in Harsul Forests, Nashik District, Maharashtra

2016
In December 2016, the presence of Forest Owlet was reported from Harsul Forests in Trimbak Taluka of Nashik District was reported (Raha et al. 2017). This makes the second record of Forest Owlet from Western Ghats of Maharashtra.

### Ecological Studies on Forest Owlet

1998 - 1999
BNHS carried out a year-long ecological survey on one pair of Forest Owlet at Toranmal Range in Nandurbar District (Ishtiaq and Rahmani 2000). The study examined habitat use, prey deliveries, breeding behaviour and vocalization of the Forest Owlet

2000 – 2004
BNHS initiated another ecological study of Forest Owlet in Toranmal Range in Nandurbar district (Jathar and Rahmani 2004). The study examined the habitat, breeding, nesting and feeding requirement of six pairs of Forest Owlet in Toranmal Range (Jathar and Rahmani 2004).

### Phylogeographic Study on Forest Owlet

2013-2016
SACON initiated a study to examine the unique populations of Forest Owlet through a phylogeographic approach and also examined phylogeny of Forest Owlet based on molecular analysis (Mukherjee et al. 2014).

## 1.4 Current Status of Forest Owlet in India

Since the time it was rediscovered till 2016, the Forest Owlet was placed in the Critically Endangered (C2a) category of the Red Data List by the IUCN. This criterion is based on the bird's small range with severely fragmented habitat (Birdlife International 2001). The Forest Owlet has been classified as Schedule I species by Indian Wildlife Protection Act (1972) and included in Appendix I of CITES. This makes it a very high priority species for conservation (Birdlife International 2016).

Presently, till December 2017, there are 12 published records of Forest Owlet occurrence in the country (Mehta et al. 2017). The twelve locations are distributed as given:

- Maharashtra: Toranmal, Taloda, Navapur-Chichpada (all in Nandurbar District), Melghat Tiger Reserve (Amravati District), Tansa Wildlife Sanctuary (Palghar District) and Harsul Forests (Nashik District)
- Madhya Pradesh: Khandwa, Burhanpur and Betul districts
- Gujarat : Dangs, Navsari and Valsad districts

## 1.5 Need for an Ecological Study on the Forest Owlet in Khandwa District

Although several surveys and two ecological studies have been carried out on the Forest Owlet in the country, there is a lot that remains to be understood about the ecological requirement of the species.

The presence of Forest Owlet in Khadwa district was reported in 2005-06. However so far there has been no attempt to study the population, demography and ecology of Forest Owlet in Madhya Pradesh. It is important to understand why the species is rare, which factors are affecting its survivability and what interventions are required for its long-term conservation in the country

Earlier literature and records of type specimen collection indicate that the distribution of the Forest Owlet ranged from Orissa in the east, to northern Maharashtra (Rasmussen and Collar 1998). Our survey across 5 states in the country indicated that the Forest Owlet probably occupies only a part of its former range. Over a period of time, the Forest Owlet range has decreased owing to loss of habitat and human pressures. This makes it imperative that its ecology and status should be well studied for its protection and conservation before the surviving population is lost.

The Forest Owlet Population in Khandwa district is surviving in Reserved Forests which are used by the local communities for collecting fuel wood, grazing their cattle and for collecting minor forest produce. There is considerable pressure of illegal tree cutting in the forests.

Being cavity nesters, the Forest Owlet require trees with suitable cavities for roosting, nesting and breeding. Forests of Khandwa Divisions are managed forests where regular logging operations are carried out. Existence of the Forest Owlet in these forests for all these years indicates that Forest Owlet is capable of surviving in managed forests. However the impact of forestry operations on the Forest Owlet is not known.

Considering the above, we established the overall goal and specific objectives of our study as given:

## 1.6 Project Goals and Objectives

The long -term goal of this project is to understand various ecological, environmental and biotic factors that affect the presence of Forest Owlet and based on the findings of our work, implement a site-specific conservation program to protect the Forest Owlet and its habitat.

Our study will be carried out in two phases at the chosen site. During the first phase, we shall carry out an ecological study on the Forest Owlet and in the second phase implement a monitoring and conservation program. This report is based on the findings of our study in the first phase.

### Objectives of the Study

- To determine the distribution of the Forest Owlet in Khandwa District of Madhya Pradesh
- To estimate the population of the Forest Owlet in the Study Area
- To determine the important demographic parameters for the Forest Owlet in the Study Area
- To study the feeding, breeding and nesting ecology of the Forest Owlet
- To study the impact of forestry operations on the Forest Owlet and advise the Forest Department on appropriate forestry practices for its conservation in the Study Area

**State Highway 26 Passing through the Study Area**

*WRCS*

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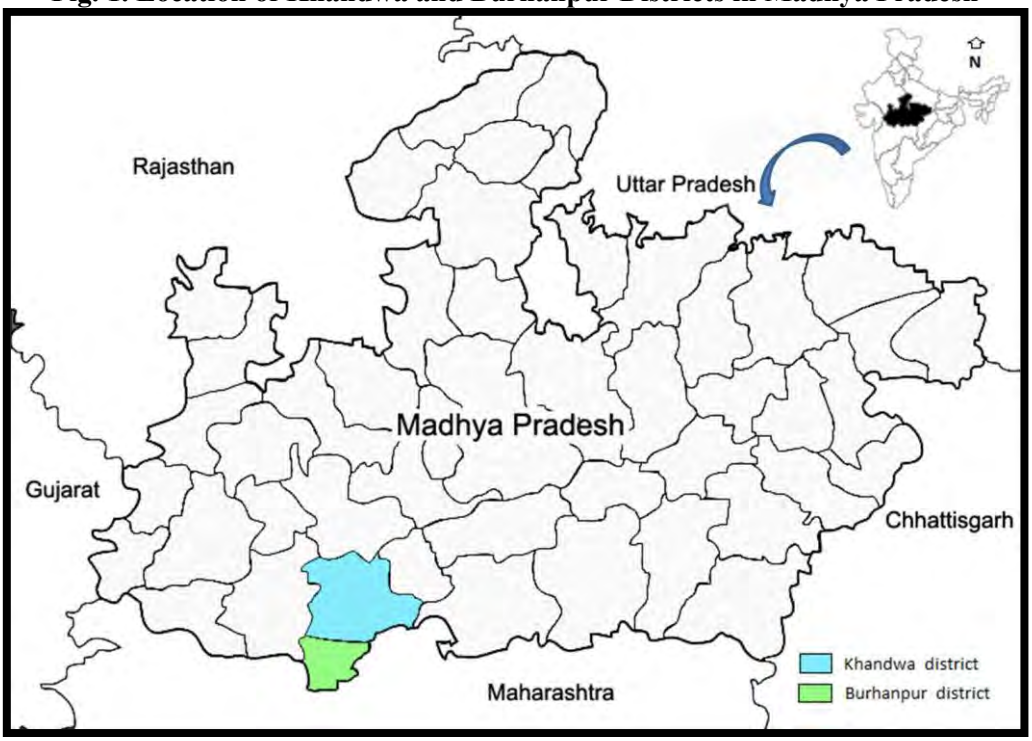
# Chapter Two
# Study Area

## 2.1 Location of Khandwa Forest Division

Khandwa Forest Division is located in Khandwa district of Madhya Pradesh in Central India. The Reserved, protected and unclassified forest of Khandwa Forest Division, is same as the civil boundaries of Khandwa district. Notified area of Khandwa division is 2837. 24 $km^2$. Khandwa division is bounded in the north by Khargone, Harda and Dewas districts, in the east by Harda and Betul districts, in the south by Maharashtra state and Burhanpur district and in the west by Khandwa and Burhanpur districts.

**Fig. 1. Location of Khandwa and Burhanpur Districts in Madhya Pradesh**




### Topography

Khandwa division is located on North Deccan Plateau, Nimar Plateau and Satpuda Hill Ranges. The topography is mostly plain but hilly in eastern and south eastern part. The area is formed by lava plains of deccan trap and basalt which are weathered and having medium to shallow weathered mantle. The soils of the plan area are mainly consisting of alluvial soil, black cotton soil and red and yellow soil (Shukla 2013).

### Climate

The climate of the area is sub-tropical with three well defined seasons. The rainy season is from mid-June to September. During this season, the area receives more than 80% rainfall due to south-west monsoon. Some winter rains are also there due to retreating monsoon. The average rainfall of the area is about 842 mm. During summer, the average maximum temperature rises up to $44^0$C while the minimum temperature during winter can dip to $7^0$C (Shukla 2013).

### Rivers

The main rivers of the area are Narmada, Khari, Ghoda Pachad, Kanad, Kali Machak, Chhoti Tawa, Tapti, Kaveri and Ajnal etc.

## Forest Type

Forests are mainly of teak dominant southern dry deciduous type. Out of the total forest area teak forest covers 73.77 % and 8. 43 % area is of associated species. Main associates of teak in top canopy are *Anogeissus latifolia, Lannea coromendelica, Terminalia alata, Butea monosperma, Diospyros melanoxylon, Boswelia serrata,* and *Garuga pinnata*. Bamboo is found mainly in hilly region of the area. *Wrightia tinctoria, Helicters isora, Zizhyphus rugosa* are the main species in the undergrowth (Shukla 2013).

## Local communities

Khandwa division is inhabited mainly by Korku and Gond tribes. There are a few Rathias as well. There are 51 forest villages in the division. Local people practice cultivation of wheat, soyabean, and corn. Local communities also collect NTFP such as Tendu leaves, Mahua, Anola, Chiraunji (Achar), Kullu gum, Dhawda gum, Baheda, Bael, Amaltas and medicinal plants from the forests.

There are totally 715 villages in Khandwa division, of which 533 villages are situated around 5 km periphery of the forest area. Of the 533 villages, 51 are forest villages and 482 revenue villages. The inhabitants of the villages are totally dependent on the forests for their daily requirements of firewood. The grazing pressure is also almost three times the carrying capacity of the forests, due to which natural regeneration is very poor. There is heavy tree cutting in the area and encroachment on the forest land (Shukla 2013).

**Local people are dependent on the forests for their livelihood needs**

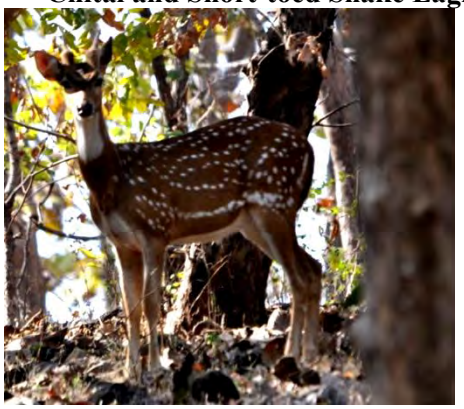
*Prachi Mehta/WRCS*

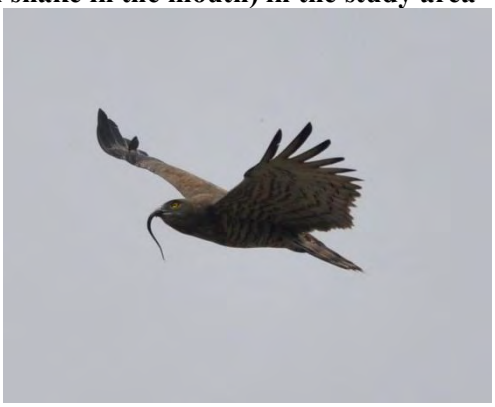
*Jayant Kulkarni /WRCS*

## Wildlife

East and West Kalibhit Forests support a good diversity of wildlife. There have been signs of presence of tiger, leopard and sloth bear in the area. Among herbivores, the area supports Chital, Nilgai, Chinkara, Muntjac and Wild Boars. The forests support good bird life. Among raptors Short-toed Eagle, White-eyed Buzzard, Shikra, Crested Serpent Eagle, Honey Buzzard have been seed frequently in the area. There are eight species of owls in the area, including the Forest Owlet which is a Schedule I species, Spotted Owlet, Jungle Owlet, Indian Scops Owl, Indian Eagle Owl, Mottled Wood Owl, Brown Fish Owl and the winter migrant Short-eared Owl. Among other birds, Parakeet, Flame-back, Minivet, Iora, Wood-shrike, Drongo, Myna, Indian Roller, Green Pigeon, Laughing Dove, Sirkeer Malkoha, Jungle Babbler, Robins are seen commonly in the forests (pers.observ.)

**Chital and Short-toed Snake Eagle (with snake in the mouth) in the study area**





*Prachi Mehta/WRCS*

## 2.2 Selection of Intensive Study Area

In December 2012 we carried out rapid field surveys in Khandwa division to select the intensive study site. We surveyed East Kalibhit Range and West Kalibhit Range in Khandwa District and Khaknar, Sunderdeo and Piplod Ranges in Burhanpur Division. During the survey, we recorded 5 Forest Owlet in Burhanpur District and 26 birds in Khandwa District. Accordingly, we decided to select Khandwa District for our long-term work.

*Jayant Kulkarni /WRCS*

**Figure 2.1: Map showing locations of Forest Owlet (Red dots) in the study area**

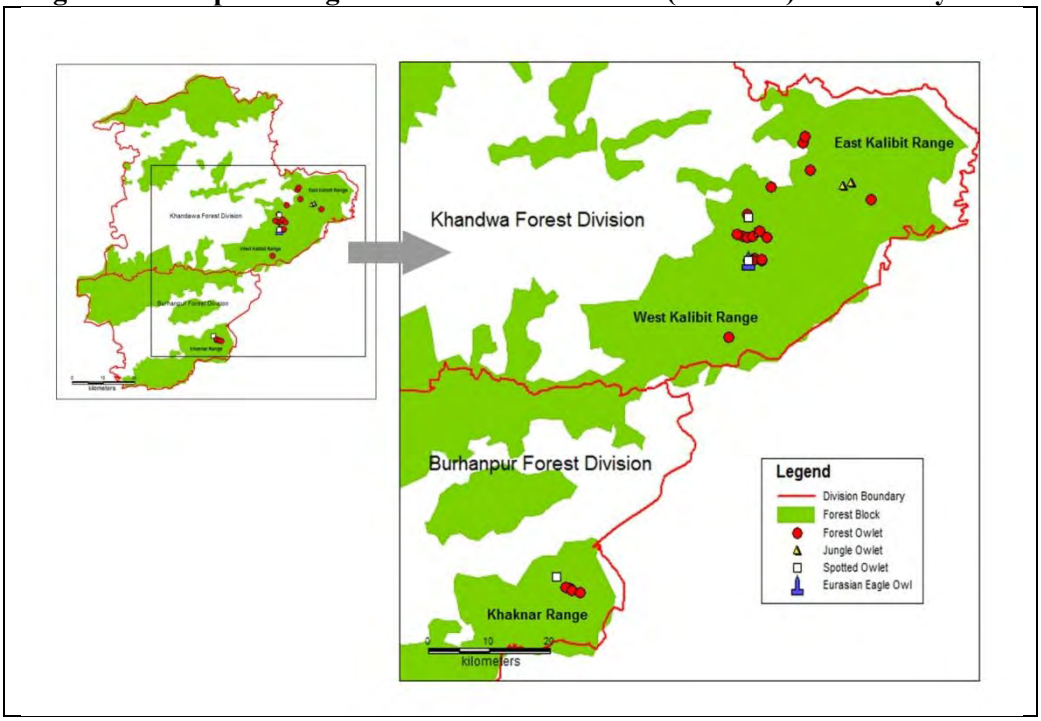



**Table 2.1: Detection of Forest Owlet During Rapid Survey (March to June 2013)**

| | |
|---|---|
| **Total Number of Grids in the study area (2 km x 2 km)** | **1863** |
| **Total Number of sub-grids in the study area (500 m x 500m)** | 29808 |
| **Number of grids surveyed from March to June 2013** | 50 |
| **Number of sub- grids surveyed from March to June 2013** | 741 |
| **Number of Forest Owlets detected** | 27 individuals: 10 males, 13 females, 1 sub-adult male, 1 sub-adult female, 2 Juveniles |

## 2.3 Selection of East Kalibhit Range as Intensive Study Area

We selected Khandwa district for the long-term study as it was currently being logged by the forest department under selection felling system. In Khandwa District, we selected East Kalibhit Range as an intensive study area as it was logistically convenient location to set up the base camp. In East Kalibhit Range, we selected a compact study area to monitor the occupancy of the forest owlet. The occupancy study design is modeled after Johnson et al. (2007) study on occupancy of Little Owl *Athena noctua*.

**Fig 2.2: Locations of forest owlet in surveyd route (Dec 2012-2013)**

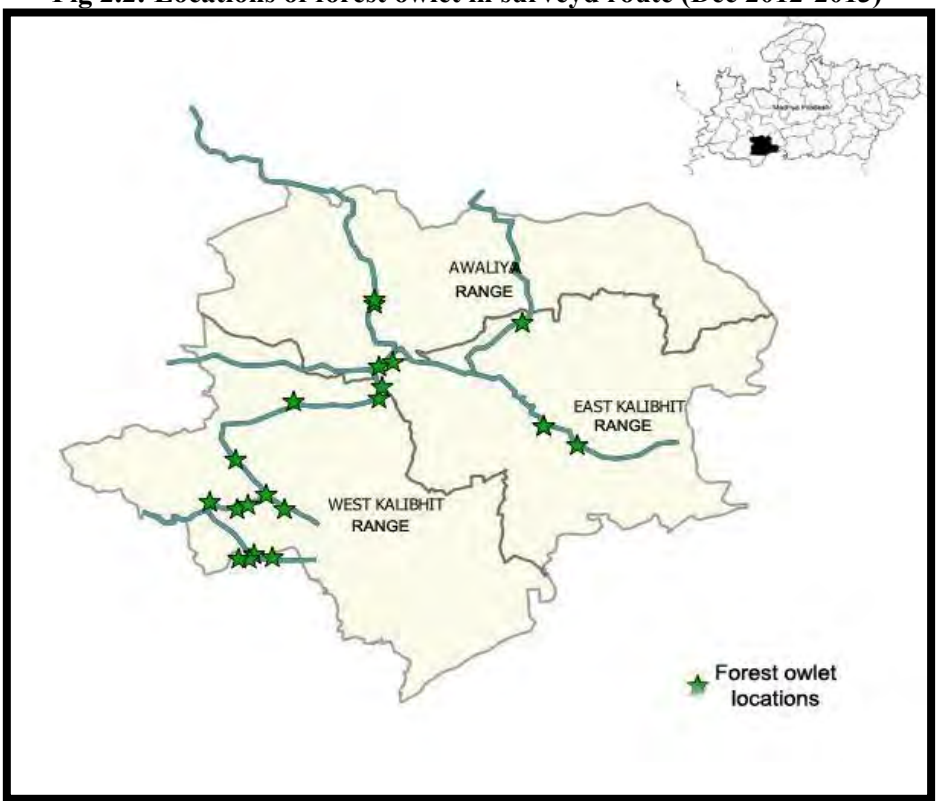



**Fig.2.3 :Location of East Kalibhit Range in Khandwa Division, Madhya Pradesh**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## 2.4 Selection of Grids for Monitoring Forest Owlet Occupancy

After a rapid survey of the area, we selected a compact area of about 100 $km^2$ to monitor the presence of forest owlet. The selected area was overlaid with 2 km x 2km survey units (main grids) Each 2 km unit was further divided in to sixteen 25 ha or 500 m x 500 m survey stations (sub-grids). Each survey unit had a geo-referenced central co-ordinate.

Totally 25 survey units were selected to monitor the forest owlet in the study area. Of these, 18 survey units were in a compact cluster and were selected because it had presence of forest owlet in the area. Additional 7 survey units were selected to assess the impacts of timber harvesting on the forest owlets. Parts of these units, known as coups, are being logged for timber by the forest department from December onwards.

**East Kalibhit Forests**

*Prachi Mehta* /WRCS

**Fig 2.4: Locations of survey units in East Kalibhit Range**

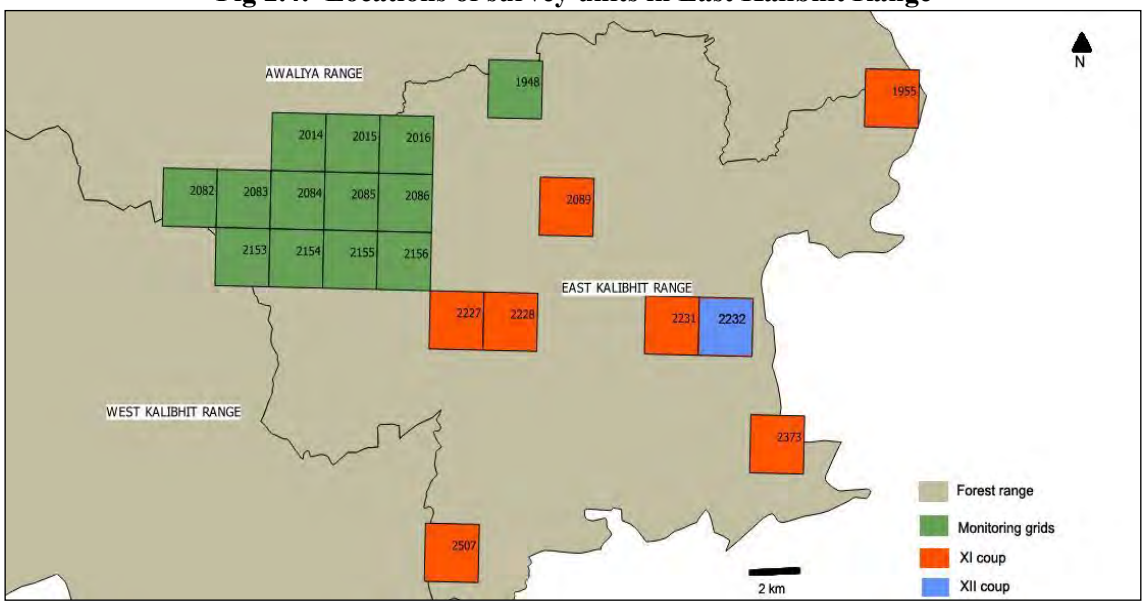

**Table 2.2: Details of Survey Units in the Study Area**

| Sr. No | Survey Units | Survey Unit Name | Habitat Status |
|---|---|---|---|
| **1** | 1873 | Kherbaba | Forest, Village |
| **2** | 1944 | New Girdikhandi | Forest, Village |
| **3** | 1945 | Bogibaba | Forest, Village |
| **4** | 1947 | New Gograghat? | Forest, Village |
| **5** | 1948 | Vikrampura | Forest, Vilalge |
| **6** | 2014 | Bhagpura | Forest, village, farms |
| **7** | 2015 | Girdikhandi | Forest |
| **8** | 2016 | Gograghat | Forest |
| **9** | 2082 | Barajoshi | Forest, village, farms |
| **10** | 2083 | Kuanala | Forest and Farm |
| **11** | 2084 | Peerbaba | Forest |
| **12** | 2085 | Bandababa | Forest |
| **13** | 2086 | Mehlu Road | Forest |
| **14** | 2089 | Kelipahdi | Forest |
| **15** | 2153 | 250 Turning | Forest |
| **16** | 2154 | Lokadgogra | Forest |
| **17** | 2155 | Muiphari | Forest |
| **18** | 2156 | Beladeo | Forest |
| **Survey Units under timber harvesting (XI and XII coup)** | | | |
| **19** | 2227 | Jhirpa | Forest |
| **20** | 2228 | Bagda | Forest, farm, village |
| **21** | 2232 | Jhinjari | Forest, road, farm |
| **22** | 2231 | Chattubattu | Forest |
| **23** | 2373 | Chadida | Forest, farm, road |
| **24** | 1955 | Khategoan | Forest |

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# Chapter 3
# Occupancy Status of Forest Owlet in East Kalibhit Range

## 3.1 Introduction

Site-occupancy is widely used to describe the presence of a species in a quantitative manner. It is defined as the probability of presence of a species in a particular patch or area. Detection of a species confirms the presence of a species but non-detection does not mean absence because a species may be present but not detected. Occupancy theory was developed to account for imperfect detection of species to estimate the true occupancy based on repetitive sampling of the survey sites. (McKenzie et al. 2004b).

In order to assess the distribution status of owls, it is important to carry out a survey in the area. Broadcast surveys are one of the most widely used techniques to locate and survey owls. Owls usually vocalize a lot while defending their territory and during courtship period. A call broadcast survey carried out during breeding period would result in eliciting response of the owl and thereby indicating its presence in the area. However often owls are absent at the time of survey but may return to the site after some time. Also at times owls are present at the site but there is no response to the call as either they chose not to respond (if they are incubating or due to the presence of a predator). In that case, no response may be recorded as false absence. It is therefore desirable that occupancy or distribution survey should be carried out in a compact area and should have repeat visits in the area for consecutive breeding season to understand how many pairs occupy the area and if they are breeding or not that year (Johnson et al. 2007).

## 3.2 Methodology

During the initial survey, we used call broadcasting to elicit a response from the Forest Owlet – if it is present in the grid. Once the owls are located in the survey unit, we use the calls sparingly to minimize the intrusion to the birds. As described in the previous chapter, we selected an intensive study area of 21 survey grids (2 km x 2km). Each survey grid was further divided in 16 survey stations that were 500 m apart.

**Fig 3.1 Design of the Survey Unit. x indicates survey stations**

| | | | |
|---|---|---|---|
| X | X | X | x |
| X | X | X | x |
| X | X | X | x |
| X | X | X | X |

At each survey station, the contact call is broadcast for a period of 2 minutes following by 3 minutes response time. This cycle is repeated twice (Johnson et al. 2007) or sometimes three times. If the bird

is detected during the survey, the survey station (and therefore the entire survey unit of 2 km x 2km) is listed as occupied. Not occupied status is given when the bird is not detected in the entire survey unit. In summer season, surveys were carried out from 0600 to 1000 hrs. and 1500 to 1800 hrs. During winter months, surveys were carried out from 0700 to 1100 hrs. and 1500 to 1730 hrs.
To confirm the actual presence or absence of the forest owlet, each survey station was visited minimum four times.

## 3.3 Results

### Occupancy of Forest Owlets in the Study Area

The number of owls detected throughout the four years of the study fluctuated. The study area being relatively small the total number of owls detected over the four years was also small. We calculated the total number of owls per month that were located within the study area.

Year 2013-2014

This was the first year of the study. In this year we recorded maximum number of Forest Owlets. This was during the month of October and December. These months are the peak of the breeding season which could be the reason for the fluctuating values in the number of birds. There were also a few months with no detection of birds. During the first year, we detected maximum number o birds, totaling to 22 individuals in the study area. During the season, there were two juveniles that had fledged. During the season of 2013-2014 there was an overall of ten 2x2 km grids occupied by the Forest Owlet. Within this there were eighteen occupied sites (500 $m^2$ sub-grids). Twelve of these sites were concentrated among 4 grids. The maximum number of birds found in one particular grid during the season was in grid 2083- Kuanala with a total of 9 birds, spread over 5 sites. Two juveniles were seen which fledged from the nest. One was in 2083- Kuanala and the other was in 2084- Peerbaba. These were the only two locations where we saw fledglings during this season.

**Fig 3.2 Number of Forest Owlet detected in 2013-14**

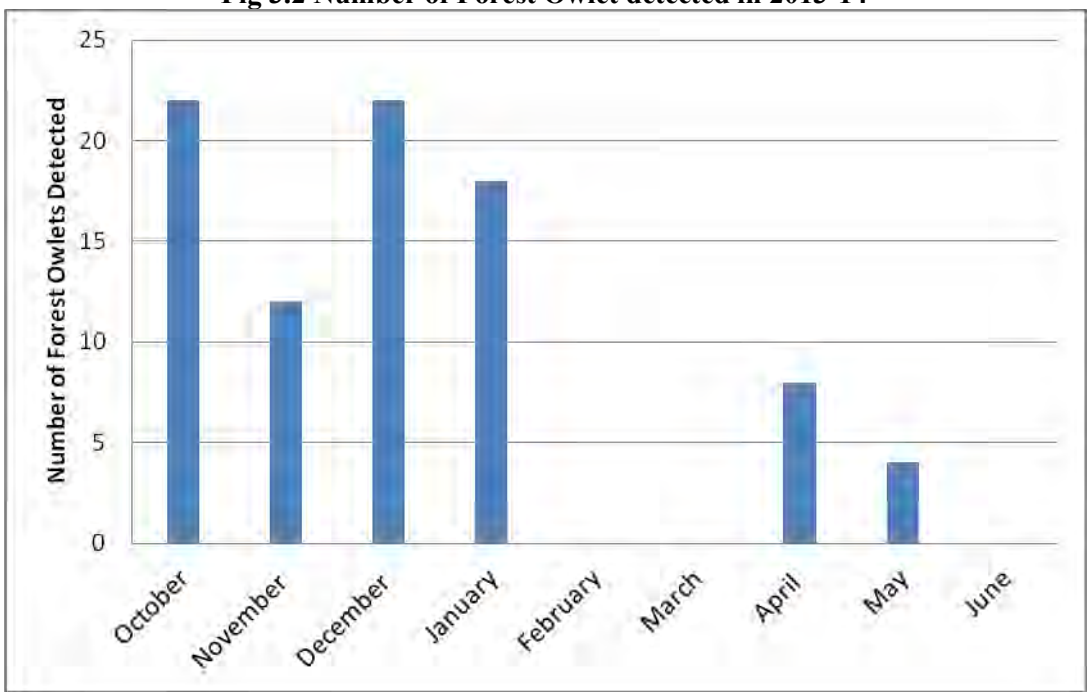
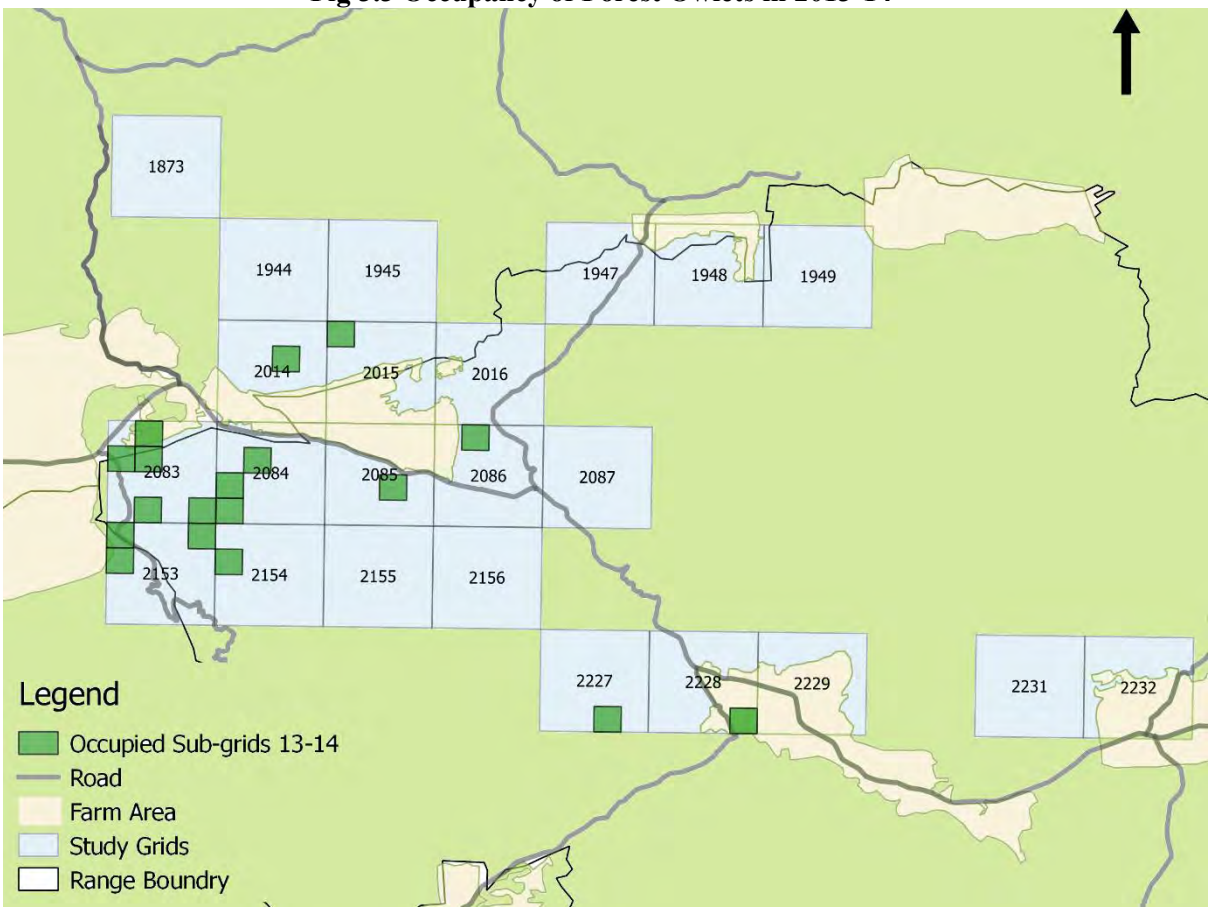


**Fig 3.3 Occupancy of Forest Owlets in 2013-14**




Year 2014-2015

This year the field work started in the month of October and ended in June. In the month of October 16 birds were detected. Over the season the number of birds were the lowest in the month of June (9 birds), which is the beginning of the monsoon season. The maximum number of birds recorded during the season was in the month of December with a total of 19 birds. These numbers are inclusive of juveniles. During the season only two juveniles successfully survived through the season. One of which was seen during the following year. This season saw an increase of Forest Owlet sites. Throughout the year we saw a total of 17 occupied grids with 36 Forest Owlet sites. This was a marked increase in the number of sites from the previous year, in fact it was a 100% increase. This doesn't necessarily mean that the number of birds have increased over the year but could indicate that the movement of birds had increased as compared to the previous year. The maximum number of birds found in a particular grid was again in 2083- Kuanala with 11 birds seen throughout the season. This same trend was seen in the previous year although there was an increase in the number of birds.

**Fig 3.4 Number of Forest Owlet Detected in 2014-15**

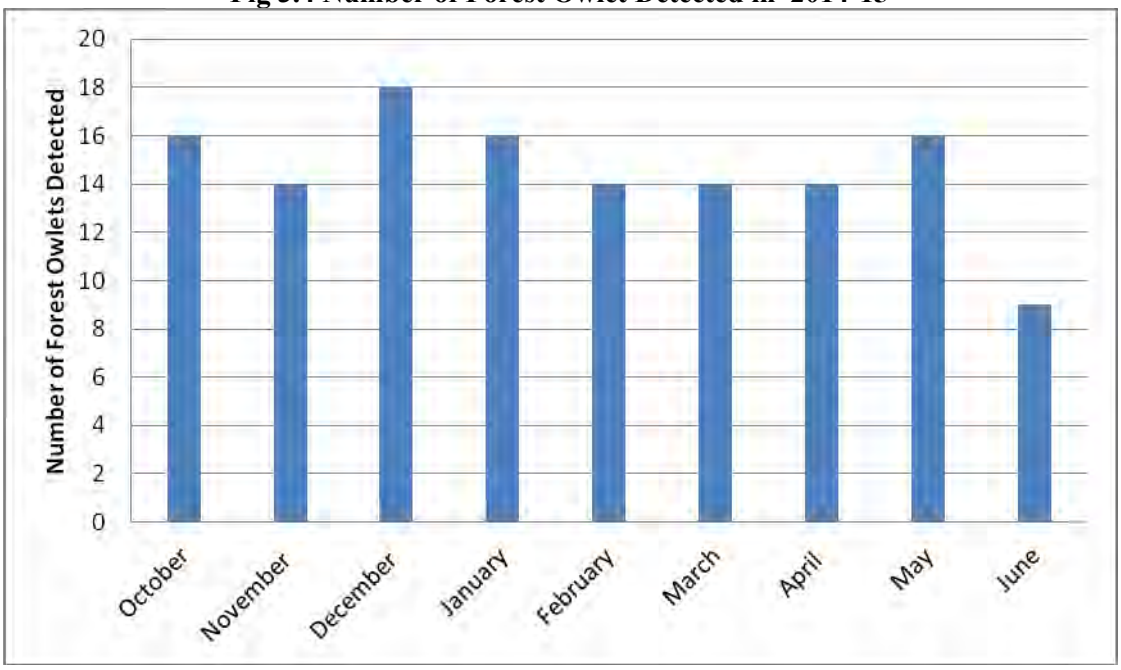
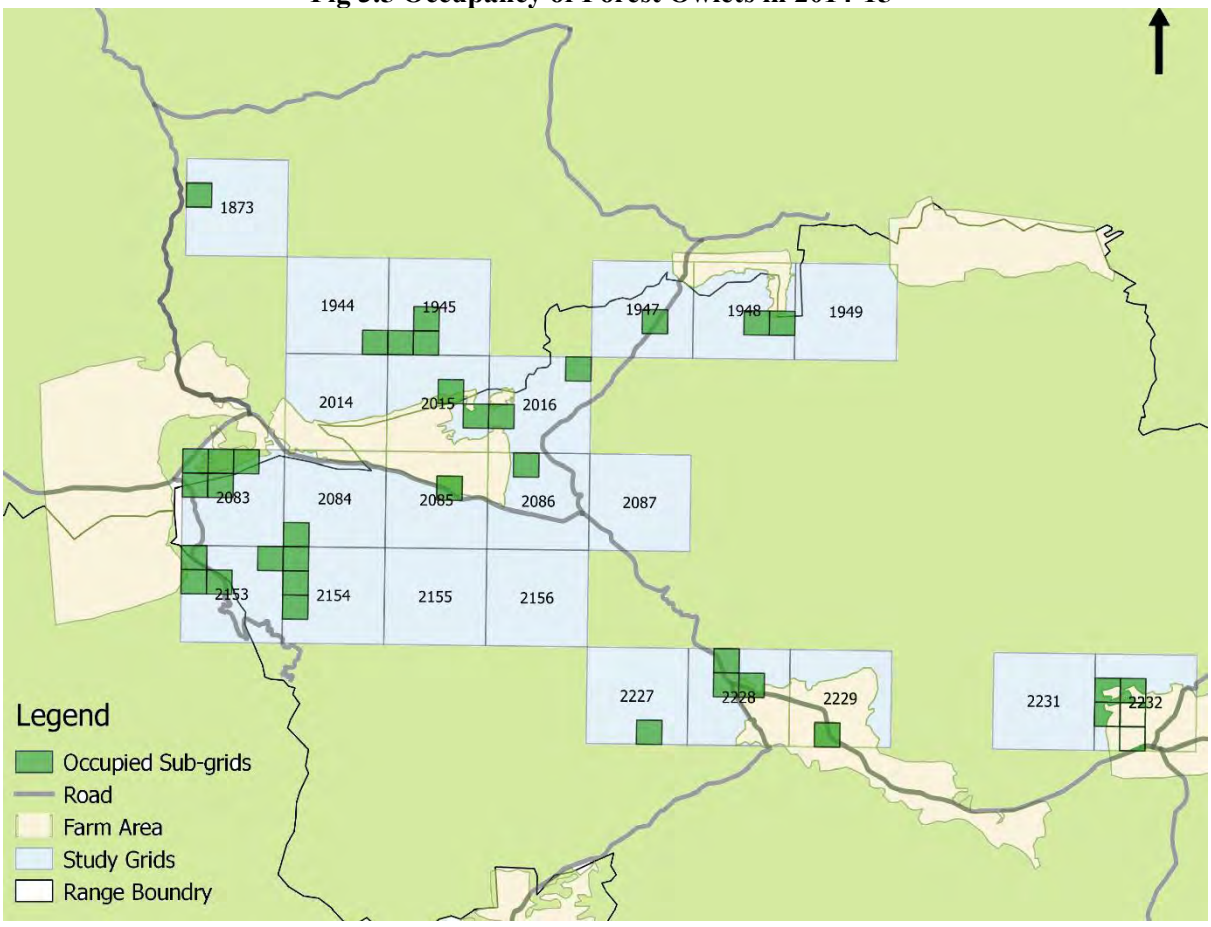



**Fig 3.5 Occupancy of Forest Owlets in 2014-15**



Year 2015-2016

This season saw large fluctuations in the number of Forest Owlets detected. The season started in October with 13 birds. During the month of February there were forest fires that spread through the entire study area. This created a sudden fall in the number of Forest Owlets located. During the month of January there were 16 birds but as of February there were only 9 birds. The following month of march saw the highest number of birds of the season with 19 birds. This sudden influx of birds could be due to the forest fires. During this influx of birds, we also located three new juveniles in two new locations. Overall 5 juveniles fledged over the season. This season had a decrease in the number of occupied grids as well as occupied sites compared to the 2014-2015 season. Through the season we saw a total of 12 occupied grids with 26 Forest Owlet sites. Grids that have shown high number of birds in the previous year's such as 2083-Kuanala had a considerable decrease in Forest Owlet occupancy. In the season we saw only 4 birds in the Kuanala grid. This was the most active site of the previous two years although this year there was only 3 sites within the sub-grid. Grid number 2229-Loodiyababa showed a stark increase in activity in this season. There was a total of 7 Forest Owlet sites in the grid. There was an influx of birds in the month of march. After this we found 3 new juveniles and three new adults. The 7 sites were almost adjacent to each other and birds were seen interacting with each other from the different sites.

**Fig 3.6. Number of Forest Owlet Detected in 2015-16**

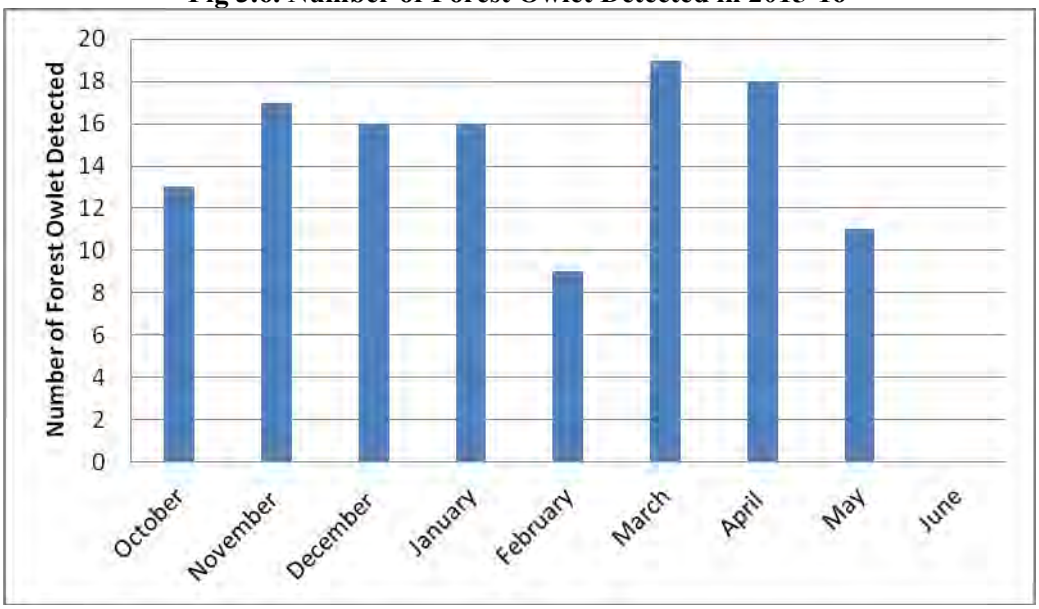
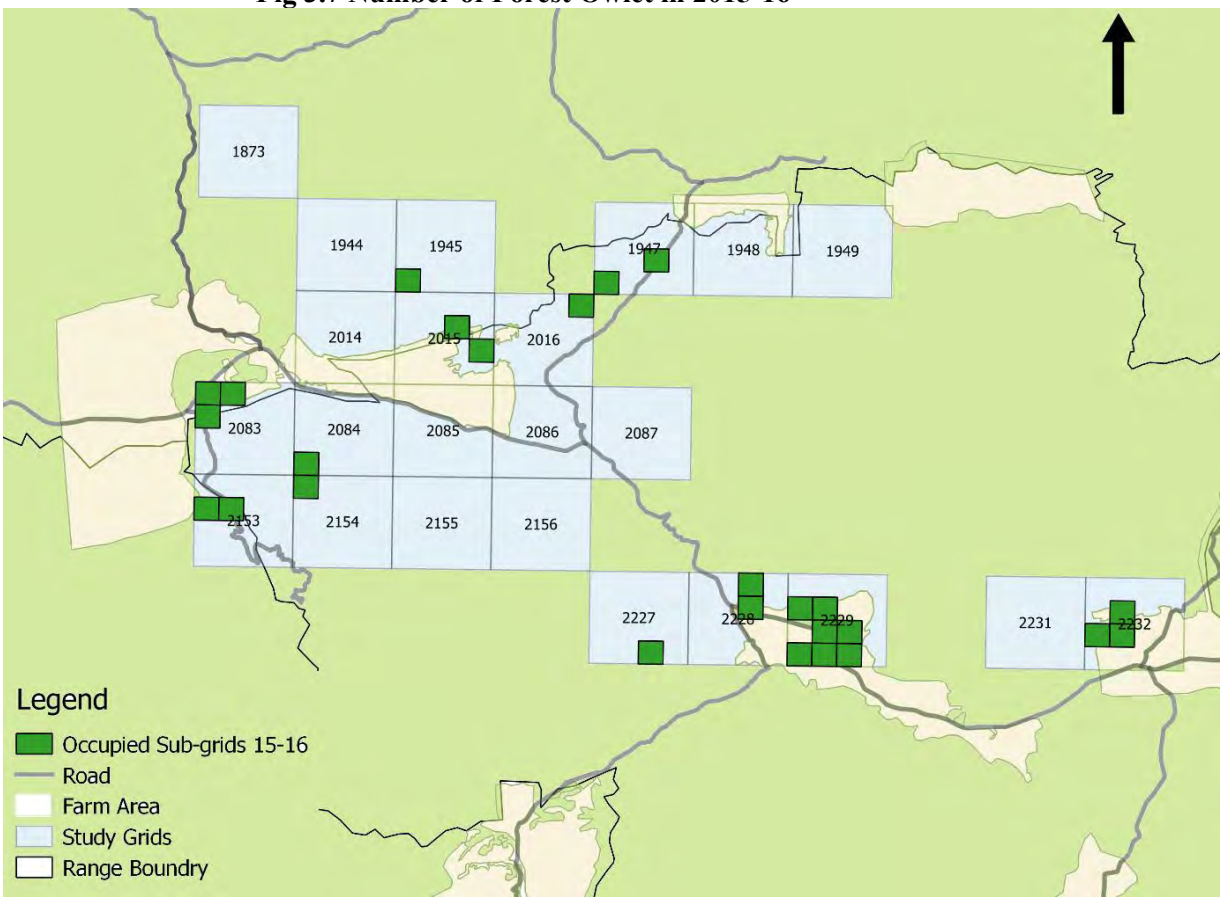


**Fig 3.7 Number of Forest Owlet in 2015-16**

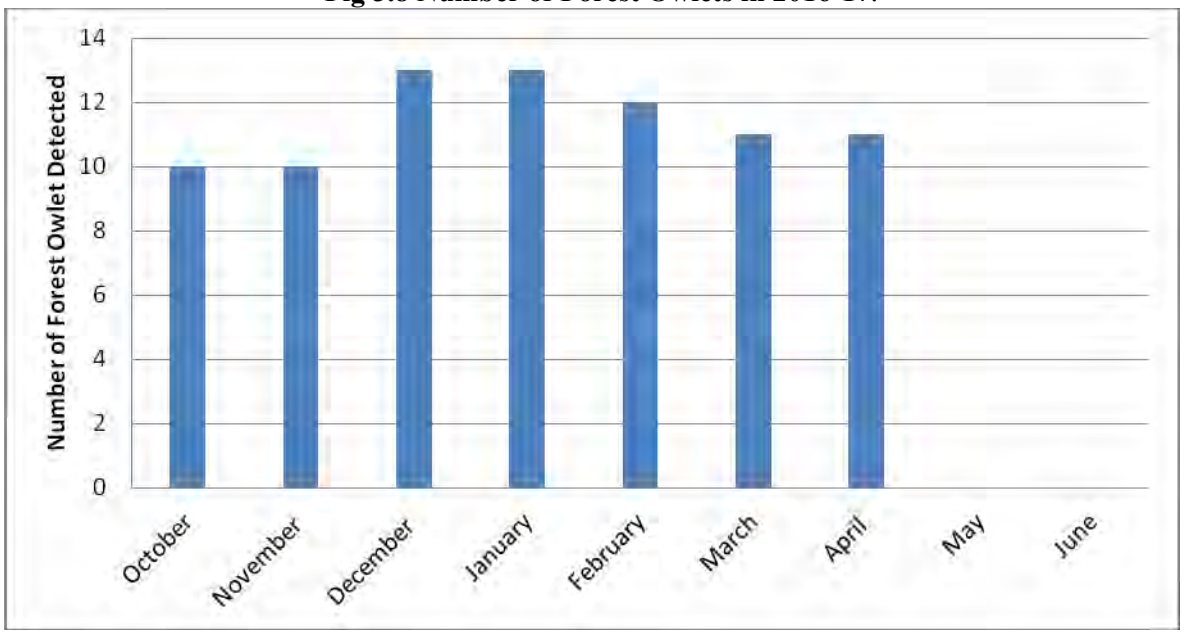



Year 2016-2017

his season had the lowest number of birds of all the previous years. In October when field work started, only 10 birds were located. The month of December had the highest number of birds with 13 birds. This was due to a new location where a pair with two juveniles were seen. This season did not see much variation in bird numbers. Unlike previous years where there was an influx of birds in a particular month, this year had fairly stagnant numbers. This season showed a further decrease in Forest Owlet sites. There were only 7 occupied grids with a mere 12 Forest Owlet sites. The Loodiyababa grid which contained 7 sites in the previous year only showed 2 sites during this season. the grid was only occupied by a single pair. The season brought forth a new site i.e. Theklech Patti-2299. Here there were 4 birds out of which two were juveniles. On two instances, old banded birds were spotted, these birds were banded in 2013. These birds were spotted in the Dhaiso Turning grid-2153, and the Bandababa grid 2085. The pair from the Kaudi location in the Jhinjri grid-2232, continued to occupy the location for the third consecutive year.

Field work was stopped in the month of April and hence the months of May and June could not be monitored.

**Fig 3.8 Number of Forest Owlets in 2016-17**.




Area Occupied by the Forest Owlet

*Prachi Mehta/WRCS*

**Fig 3.9 Occupancy of Forest Owlets in 2016-17**

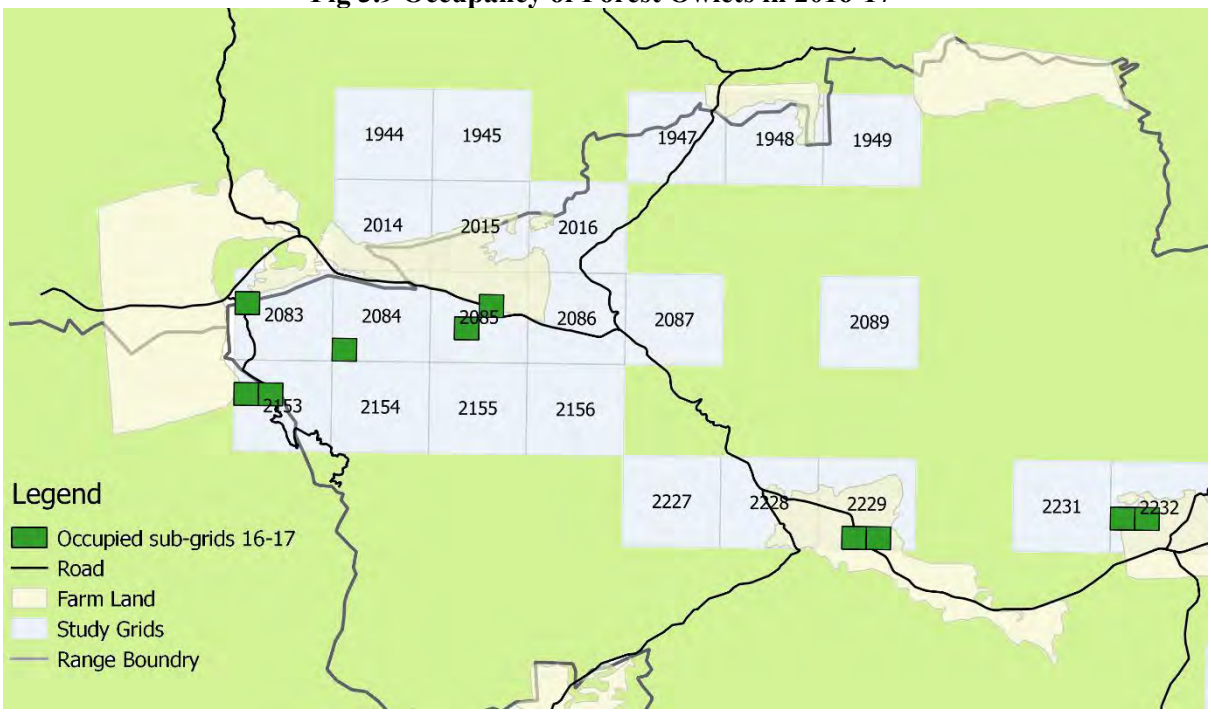



**Fig.3.10 Sites Occupied by the Forest Owlet in the Study Area (Dec 2013 to April 2017)**

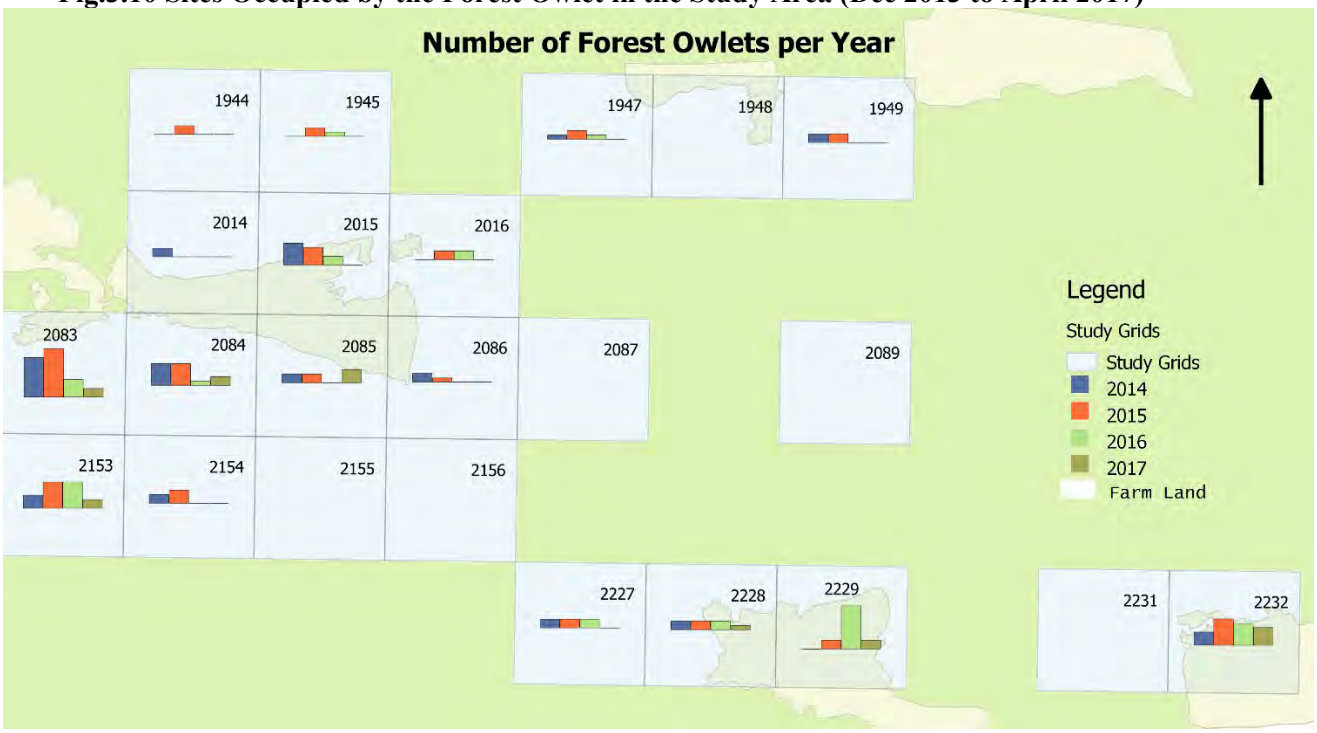


**Table 3.2 Grids Occupied by Forest Owlets (2013-2017)**

| Grid Number | Grid Name |
|---|---|
| **2083** | Kuanala |
| **2084** | Barajoshi |
| **2085** | Peerbaba |
| **2153** | 250 Turning |
| **2154** | Lokad Gogra |
| **2227** | Jhirpa |
| **2228** | Bagda |
| **2229** | Loodiyababa |
| **2232** | Jhinjari |
| **2299** | Theklechpati |

**Forest Owlet Habitat in the East Kalibhit Range**

*Prachi Mehta/WRCS*

## 3.4 Habitat Occupied by Forest Owlet in the Study Area

### Methodology

Habitat assessment was carried in a grid-wise manner in each 500 x 500 m grid of the study area. Quadrats of size 20 x 20 m were laid at the centre of each grid. The vegetation was divided in three strata: tree, shrub and ground cover. The study was carried out in 434 subgrids. The habitat parameters measured were as follows:

- Geographical measured were slope and elevation.
- In each quadrat the trees were enumerated by species. The height and girth at breast height of each species was measured. The canopy density was estimated by densiometer.
- Shrub species and density was estimated by intercept method.
- Human disturbance was measured in a 30m radius circle. The parameters measured were number of logged tree stumps, number of cut tree stumps

Some habitat factors were measured from Google Earth. These included distance from agriculture, distance from road and % of forest in a 500 x 500 m subgrid.

## 3.5 Results

- The Forest Owlet occurs in a narrower elevation range in the study area. It did not occur at elevations higher than 504 m in the surveyed subgrids.
- The Forest Owlet was found at low to medium slopes. It was not found at higher slopes.
- Average tree GBH was between 13 to 97 cm.
- The average tree height ranged from 7.8 to 18.1 m.
- The tree density ranged from 250 to 900 trees/ha.
- The Forest Owlet was found in areas with an average of 82.4% forest area.
- The Forest Owlet occurred in areas nearer to agriculture areas.
- The distance from agriculture ranged from 0 to 2157 m.
- The average distance from agriculture of the subgrids with forest owlet presence (537m) was less than the average distance of all subgrids in the study area (1093m).
- The average distance from roads of subgrids with forest owlet presence (895m) was less than the average distance of all subgrids in the study area.

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MacKenzie, D. I., J. D. Nichols, J. A. Brown, and J. D. Nichols. 2004b. Occupancy estimation and modeling for rare and elusive populations. Pages. 149–172. *in* W. L. Thompson, editor. Sampling rare or elusive species. Island Press, Washington, D.C., USA

# Chapter Four
# Demography of Forest Owlet

## 4.1 Introduction

Color-banding of individual birds is a widely used method in avian ecology. Color-banded birds are useful for monitoring movement, behavior and ecology of individuals. Also, using color-bands one can identify individual birds in the field without recapturing them (Howitz 1981, Balph 1992, Gustafson 1997). Colored plastic leg bands often are used for this purpose and can be highly effective (Howitz 1981). Color-banding is a non-invasive procedure and does not hinder the activity of bird in any way. Moreover, color-banding is an inexpensive and relatively simple method for studying demography, breeding, nesting, and home-range of the bird.

Ours is the first study which proposed to use color-bands to study the Forest Owlet in the country. Since the Forest Owlet is a Schedule I species, we requested Inspector General (Wildlife), Ministry of Environment, Forests and Climate Change (MoEFCC), New Delhi and the Office of Chief Wildlife Warden, Madhya Pradesh. for the permissions. We received the permission to carry out color-banding of Forest Owlet from both the offices.

Earlier, the Principal Investigator has carried out mist-netting and color banding of passerines at the Wildlife Institute of India (WII, Dehradun) and with Dr. Balachandran from BNHS. In 2013, the PI and Co-PI participated in Owl Research Monitoring Program at the Northern Owl Research Centre with Dr. Janice Reid, Program Manager of Spotted Owl with USFWS at Oregon and the Little Owl Research Station at Hermiston with Mr. David Johnson who head the Global Owl Project. This training proved to be immensely useful for various aspects of the work on the Forest Owlet in the study area.

For learning the bird trapping methods, we invited Mr. Ali Hussein on the recommendation of Dr. Asad Rahmani, former Director of BNHS. Mr. Ali Hussein is an expert in developing methods for trapping birds and has worked extensively on bird banding projects with BNHS. Mr. Hussein has helped and trained many scientists in India and outside the country in developing appropriate trap for various bird species.

## 4.2 Methodology

Ali Hussein developed a simple trap for capturing the bird. It was modeled on Bal-chatri net. It proved to be useful in capturing the Forest Owlet. On capturing the bird, we weighed the bird and took measurements of its body, installed the color-bands and released it within 15 minutes.

We used AVINET color-bands which are used by many bird researchers as they are made of UV resistant plastic and is light weight. The weight of each color band was 0.1g.

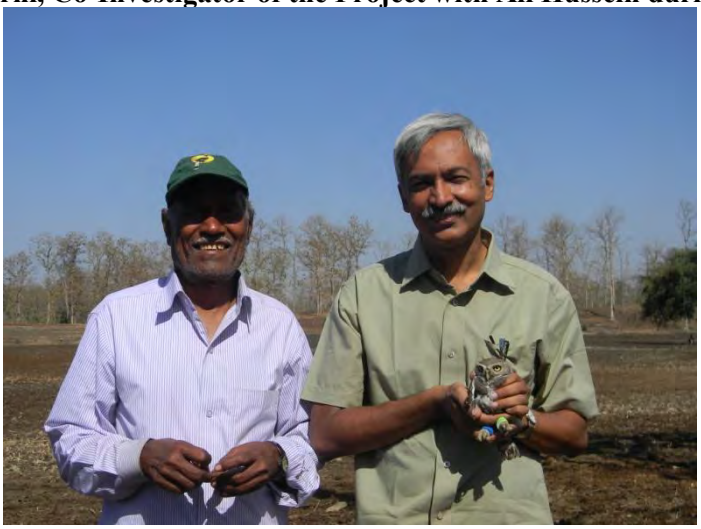
We decided the following protocol for color-banding.

- Each bird will have same number of colored bands
- The left leg will have two colored bands for individual identification
- The right leg will have BNHS ring at the bottom and the sex band on top. The BNHS ring was later discontinued. So we
- For the female, we used red colored band on the right leg
- For the male, we used blue colored band on the right leg
- For the juvenile, we used green colored band on the right leg

Color –banding was carried out early morning or in the mid-afternoon. After locating the bird, the traps were placed in most visible location for the bird.

**Mr. Ali Huseein and his colleague at the field site**

**Mr. Jayant Kulkarni, Co-Investigator of the Project with Ali Hussein during Color banding**



**Dr. Mehta and Mr. Akshay Anand banding the Forest Owlet**

## 4.3 Results

During the study, we could color band 50 Forest Owlets. This included 23 females, 19 males and 8 juveniles. The total banded birds included 14 pairs of Forest Owlets. Apart from the banded birds, we observed 7 more Forest Owlets in different locations but they were not banded. As per our banding records, the study area supports at least 57 Forest Owlets.

**Table 4.1. Details of Color-Banded Forest Owlets in the Study Area (2013-2017)**

| Sr. | Survey unit | Survey Station | Location | Bird Banding Code | Sex | Right Leg BNHS Ring Down+ Band Up | Left Leg Up/Down |
|---|---|---|---|---|---|---|---|
| **1** | 1945 | 30966 | Kula Bura | GRF1 | F | Red/F59778 | Purple/Pink |
| **2** | 1948 | 30428 | Vikrampura | VKM1 | M | Blue/59771 | Sky Blue/Orange |
| **3** | 2014 | 31519 | Bhag Pura | BPF1 | F | Red/F59754 | Green/Yellow |
| **4** | 2016 | 31251 | Ghoghragh at | GGF1 | F | Red/F59804 | Blue/Yellow |
| **5** | 2083 | 32345 | Kua Nala | KNM1 | M | Blue/F59753 | Yellow/Green |
| **6** | 2083 | 32621 | Barajoshi | BJM1 | M | Blue/F59757 | Orange/Black |
| **7** | 2083 | 32344 | Govind Nala | GNM1 | M | Blue/F59763 | Black/Black |
| **8** | 2083 | 32344 | Govind Nala | GNF1 | F | Red/F59764 | Yellow/Yellow |
| **9** | 2083 | 33178 | Jhanda baba | JBM1 | M | Blue/59772 | Red/Orange |
| **10** | 2083 | 32344 | Govind Nala | GNF2 | F | Red/F59777 | Pink/Black |
| **11** | 2083 | 32345 | Kua Nala | KNF2 | F | Red/F59780 | Red/Blue |
| **12** | 2083 | 32621 | Barajoshi | BJF2 | F | Red | Black/Dark Blue |
| **13** | 2084 | 32902 | Jhanda baba | JBF1 | F | Red/F59758 | Green/Orange |
| **14** | 2084 | 32626 | Jamun Nala | JNM1 | M | Blue/F59760 | Sky Blue/Orange |
| **15** | 2084 | 33179 | Peer Baba | PBJ1 | J | Green/F59756 | Yellow/Black |
| **16** | 2084 | 32626 | Jamun Nala | JNF1 | F | Red/F59767 | Green/Red |
| **17** | 2084 | 33179 | Peer Baba | PBM1 | M | Blue/F69766 | Blue/Blue |
| **18** | 2085 | 32908 | Banda Baba | BBF1 | F | Red | Red/Pink |
| **19** | 2085 | 32908 | Banda Baba | BBJ1 | J | Green/F59850 | Orange/Orange |
| **20** | 2086 | 32357 | Mehlu Road | MRF1 | F | Red/F59759 | Yellow/Sky Blue |
| **21** | 2086 | 32357 | Mehlu Road | MRM1 | M | Blue/F59754 | Green/Green |
| **22** | 2153 | 33729 | 250 Turning | DTF1 | F | Red/F59751 | Red/Yellow |

| Sr. | Survey unit | Survey Station | Location | Bird Banding Code | Sex | Right Leg BNHS Ring Down+ Band Up | Left Leg Up/Down |
|---|---|---|---|---|---|---|---|
| **23** | 2153 | 33729 | 250 Turning | DTM1 | M | Blue/59770 | Yellow/Blue |
| **24** | 2153 | 33452 | Kekada | KDF1 | F | Red/F9774 | Black/Yellow |
| **25** | 2153 | 33729 | Kekada | KDF2 | F | Red/F59808 | Orange/Blue |
| **26** | 2154 | 33729 | 250 Turning | DTJ1 | J | Green/F59762 | Sky Blue/Sky Blue |
| **27** | 2154 | 33733 | Lokad Gogra | LGF1 | F | Red/F59765 | Yellow/Sky Blue |
| **28** | 2228 | 35414 | Bagda | BGF1 | F | Red/F9775 | Black/Green |
| **29** | 2228 | 34859 | Bagda | BGM1 | M | Blue/F59806 | Black/Orange |
| **30** | 2229 | 35416 | Ludiyababa | LBJ1 | J | Green/F59803 | Blue/Skyblue |
| **31** | 2229 | 35416 | Loodiyababa | LBJ2 | J | Green/F59807 | Orange/Yellow |
| **32** | 2229 | 35416 | Ludiyababa | LBM1 | M | Blue/F59809 | Black/Red |
| **33** | 2229 | 35416 | Ludiyababa | LBF1 | F | Red/F59810 | Green/Blue |
| **34** | 2229 | 35138 | Bagdeballa | BLF1 | F | Red/F59811 | Blue/Black |
| **35** | 2229 | 35138 | Bagdeballa | BLJ1 | J | Green/F59812 | Blue/Green |
| **36** | 2229 | 35416 | Ludiyababa | LBJ3 | J | Greeen/F59813 | Blue/Red |
| **37** | 2229 | 35416 | Ludiyababa | LBM2 | M | Blue | Orange/Red |
| **38** | 2229 | 35972 | Theklech | TPM1 | M | - | - |
| **39** | 2229 | 35416 | Ludiyababa | LBF2 | F | Red | Red/green |
| **40** | 2232 | 35150 | Jhinjhari | JHF1 | F | Red/F59768 | Sky Blue/Green |
| **41** | 2232 | 35150 | Jhinjhari | JHM1 | M | Blue/F59769 | Green/Sky Blue |
| **42** | 2232 | 34873 | Jhinjari | JHM2 | M | Blue/59773 | Blue/Orange |
| **43** | 2232 | 35150 | Kaudi | KUJ1 | J | Green/F59779 | Pink/Blue |
| **44** | 2232 | 35150 | Jhinjri | JHM3 | M | Blue/F59801 | Green/Black |
| **45** | 2232 | 35150 | Jhinjri | KUM1 | M | Blue/F59802 | Skyblue/Red |
| **46** | 2232 | 35151 | Kaudi | KUF1 | F | Red/F59805 | Orange/Green |
| **47** | 2232 | 35151 | Kaudi | KUF1 | F | Red-Black | |
| **48** | Awliya Range | Awliya Range | Bhajudana | BDM1 | M | Blue/F59755 | Yellow/Orange |
| **49** | Awliya Range | Awliya Range | Kher Baba | KBM1 | M | Blue/F59761 | Black/Sky blue |
| **50** | | | Harda river-West Kalibhit | HRF1 | F | Red/F59776 | Red/Black |

**Table 4.2: Details of Banded Forest Owlet Females, Males and Juveniles in the Study Area**

| Survey Unit | Location Name | Banded female | Banded Male | Banded Pair | Banded Bird Paired with Unbanded | Banded Juvenile | TOTAL BIRDS |
|---|---|---|---|---|---|---|---|
| **1945** | Kula Bura | KLF1 | 0 | 0 | 0 | 0 | 1 |
| **1948** | Vikrampura | 0 | VKM1 | 0 | 0 | 0 | 1 |
| **2014** | Bhagpura | BPF1 | 0 | 0 | 0 | 0 | 1 |
| **2016** | Ghoghraghat | GGF1 | 0 | 0 | GGF1+ M | 0 | 2 |
| **2083** | Kuanala | KNF1 | KNM1 | KNF1+KNM1 | 0 | 0 | 2 |
| **2083** | Kuanala | KNF2 | 0 | 0 | 0 | 0 | 1 |
| **2083** | Barajoshi | BJF1 | BJM1 | BJF1+BJM1 | BJF1+M | 0 | 2 |
| **2083** | Barajoshi | BJF2 | 0 | 0 | 0 | 0 | 2 |
| **2083** | Govindnala | GNF1 | GNM1 | GNF1+GNM1 | 0 | 0 | 2 |
| **2083** | Jhandababa | JBF1 | JBM1 | JBM1+JBF1 | 0 | 0 | 2 |
| **2084** | Jamunala | JNF1 | JNM1 | JNF1+JNM1 | 0 | 0 | 2 |
| **2084** | Peerbaba | PBF1 | PBM1 | PBF1+PBM1 | 0 | PBJ1 | 3 |
| **2085** | Bandababa | BBF1 | BBM1 | BBM1+BBF1 | 0 | BBJ1 | 3 |
| **2086** | Mehlu Road | MRF1 | MRM1 | MRF1+MRM1 | 0 | 0 | 2 |
| **2153** | Kekada | KDF2 | KDM1 | KDF2+KDM1 | 0 | 0 | 2 |
| **2153** | Kekada | 0 | DTM1 | 0 | 0 | 0 | 1 |
| **2153** | 250 Turning | KDF1 | 0 | 0 | KDF1+1 | 0 | 1 |
| **2153** | 250 Turning | 0 | 0 | 0 | 0 | DTJ1 | 1 |
| **2154** | Lokhadgoghra | LKF1 | 0 | 0 | LKF1+1 | 0 | 2 |
| **2228** | Bagda | BGF1 | BGM1 | BGM1+BGF1 | 0 | 0 | 2 |
| **2228** | Bagda | | | | BGM1+1 | | 1 |
| **2229** | Loodiyababa | 0 | 0 | 0 | 0 | LBJ1 | 1 |
| **2229** | Loodiyababa | LBF1 | LBM1 | LBF1+LBM1 | 0 | LBJ2 | 3 |
| **2229** | Bagdeballa | BLF1 | 0 | 0 | BLF1+1 | BLJ1 | 3 |
| **2229** | Loodiyababa | 0 | 0 | 0 | 0 | LBJ3 | 1 |
| **2229** | Loodiyababa | LBF2 | LBM2 | LBF2+LBM2 | 0 | 0 | 2 |
| **2232** | Jhinjri | JHF1 | JHM1 | JHF1+JHM1 | 0 | 0 | 2 |
| **2232** | Jhinjri | 0 | JHM2 | 0 | JHM2+1 | 0 | 2 |
| **2232** | Jhinjri | 0 | JHM3 | 0 | 0 | 0 | 1 |
| **2232** | Kaudi | KUF1 | KUM1 | KUF1+KUM1 | | KUJ1 | 3 |
| | **Kherbaba** | | KBM1 | | | | 1 |
| | **Vikrampura** | HRF1 | | | | | 1 |
| | **TOTAL** | **23** | **19** | **14** | **7** | **8** | **57** |

Following section provides details of color-banded Forest Owlets the study area. The photos are credited to Dr. Prachi Mehta/WRCS and Mr. Akshay Anand.

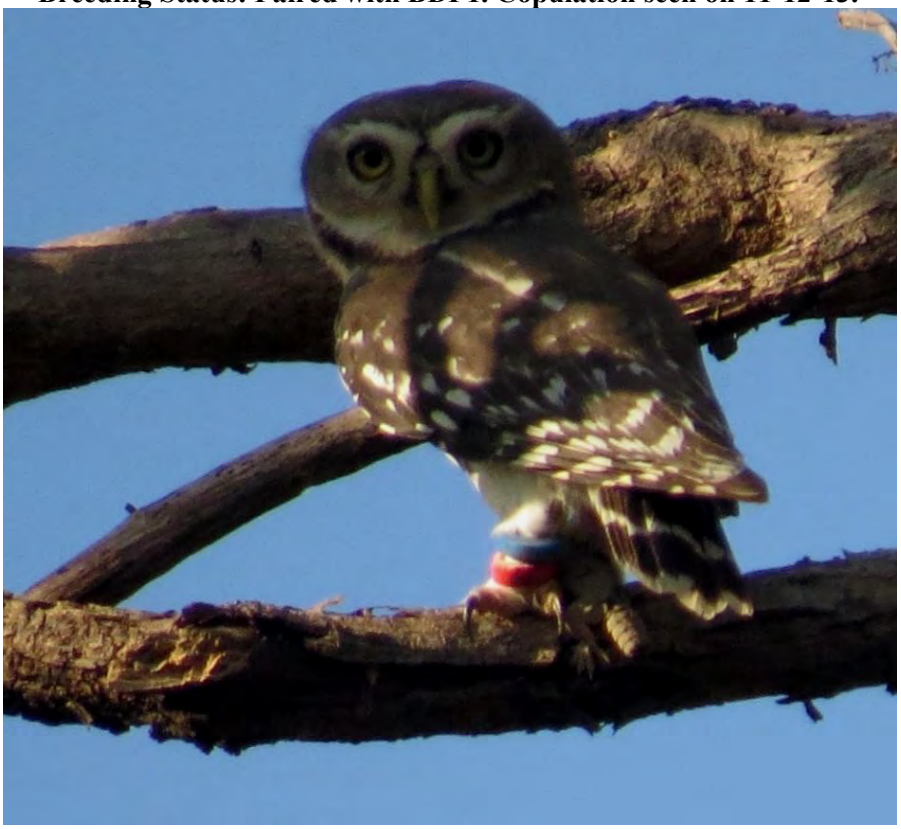
**Profile of Bandababa Female (BBF1).**
**Location: Bandababa (2085) Banding Date: 3-4-13**
**Breeding Status: Paired with an unbanded male, 3 juveniles seen in the 2013-2014 season.**

**Profile of Bandababa Juvenile (BBJ1)**
**Location: Bandababa (2085) Banding Date: 1-4-14 Sex: Unknown**
**Status: Juvenile of BBF1 and unbanded male.**

**Profile of Kuanala Female 1(KNF1)**
**Location: Kuanala-2083. Banding Date: 30-3-13**
**Breeding Status: Paired with KNM1, Copulation seen on 6-10-13**

**Profile of Kuanala Male 1(KNM1).**
**Location: Kuanala-2083. Banding Date: 30-3-13**
**Breeding Status: Paired with KNF1, Copulation seen on 6-10-13.**

**Profle of Bhoujudana Male (BDM1)**
**Location: Bhoujudana. Banding Date: 25-2-14 Sex: Male**
**Breeding Status: Paired with BDF1. Copulation seen on 11-12-13.**



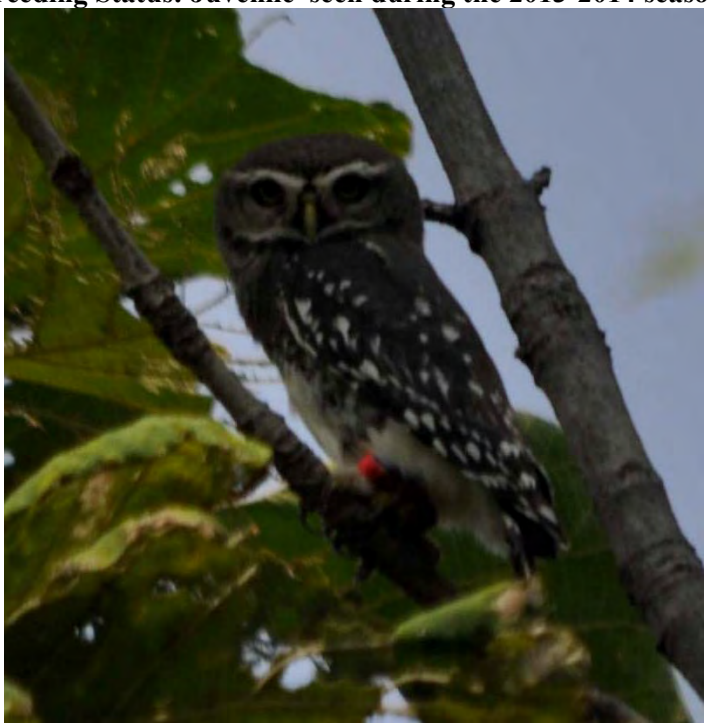
**Profile of Bhoujudana Female 1 (BDf1).**
**Location: Bhoujudana Banding Date: 2-4-13 Sex: Female**
**Breeding Status: Paired with BDM1, copulation seen on 11-12-13.**

**Profile of Kherbaba Male KBM1**
**Location- Kherbaba-1873 Banding Date: 25-2-14**
**Breeding Status: Paired with KBF1**

**Location: Barajoshi-2083 Banding Code: BJM1 Banding Date: 26-2-14 Sex: Male**
**Breeding Status: Paired with BJF2. Juvenile seen in Deceber 2013.**

**Profile of Barajoshi Female 1(BJF1).**
**Location: Barajoshi-2083. Banding Date: 4-4-13**
**Breeding Status: Paired with BJM1, Juvenile seen in December 2013.**

**Profileof 250 Turning Female 1 (DTF1).**
**Location: Dhaiso Turning-2153. Banding Date: 7-10-13**
**Breeding Status: Juvenile seen during the 2013-2014 season.**



**Profile of Bhagpura Female 1(BPF1)**

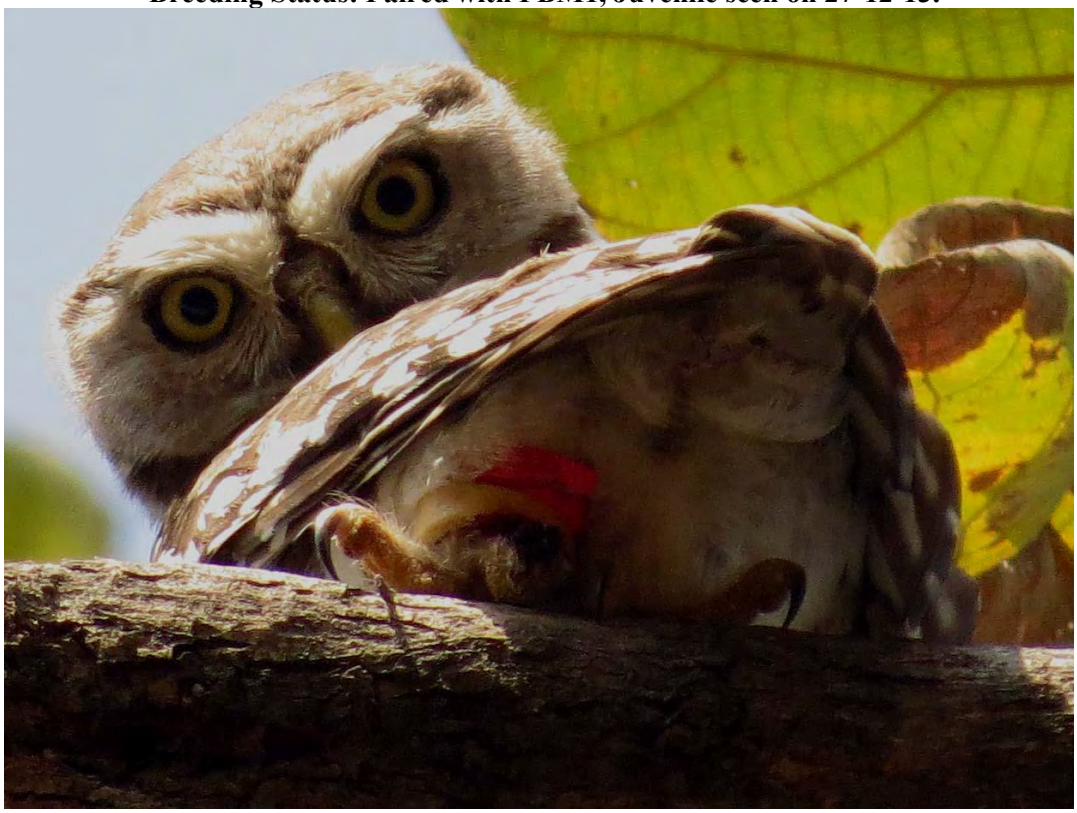
**Location: Bhagpura-2014. Banding Date: 10-12-13**
**Breeding Status: Single female.**

**Profile of Mehlu Road Female 1(MRF1).**
**Location: Mehlu Road-2086. Banding Date: 26-2-14**
**Breeding Status: Paired with MRM1.**

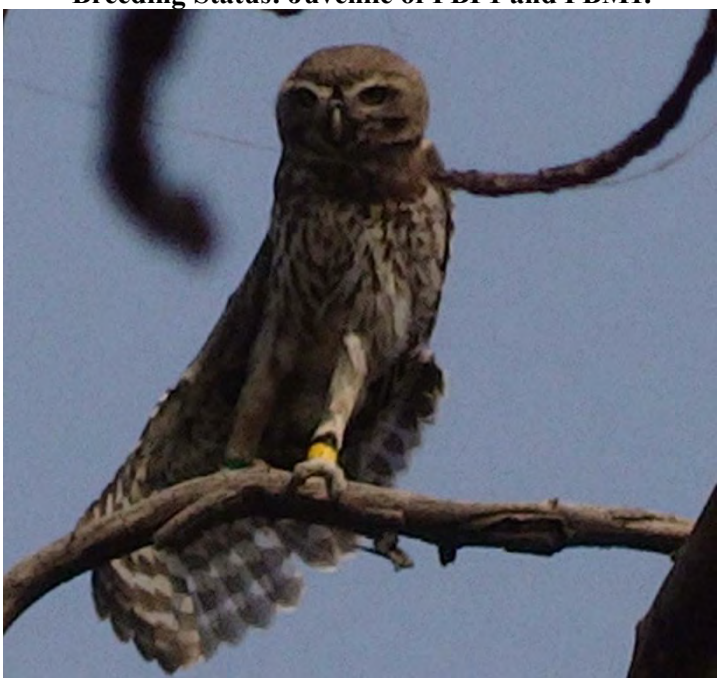
**Profile of Mehlu Road Male (MRM1)**
**Location: Mehlu Road-2086. Banding Date: 2-3-14**
**Breeding Status: Paired with MRF1**

**Profile of Peerbaba Male 1(PBM1)**
**Location: Peerbaba-2084 . Banding Date: 3-3-14**
**Breeding Status: Paired with PBF1, Juvenile seen outside of nest on 27-12-13.**

**Profile of Peerbaba Female 1(PBF1).**
**Location: Peerbaba-2084. Banding Date: 5-4-13**
**Breeding Status: Paired with PBM1, Juvenile seen on 27-12-13.**



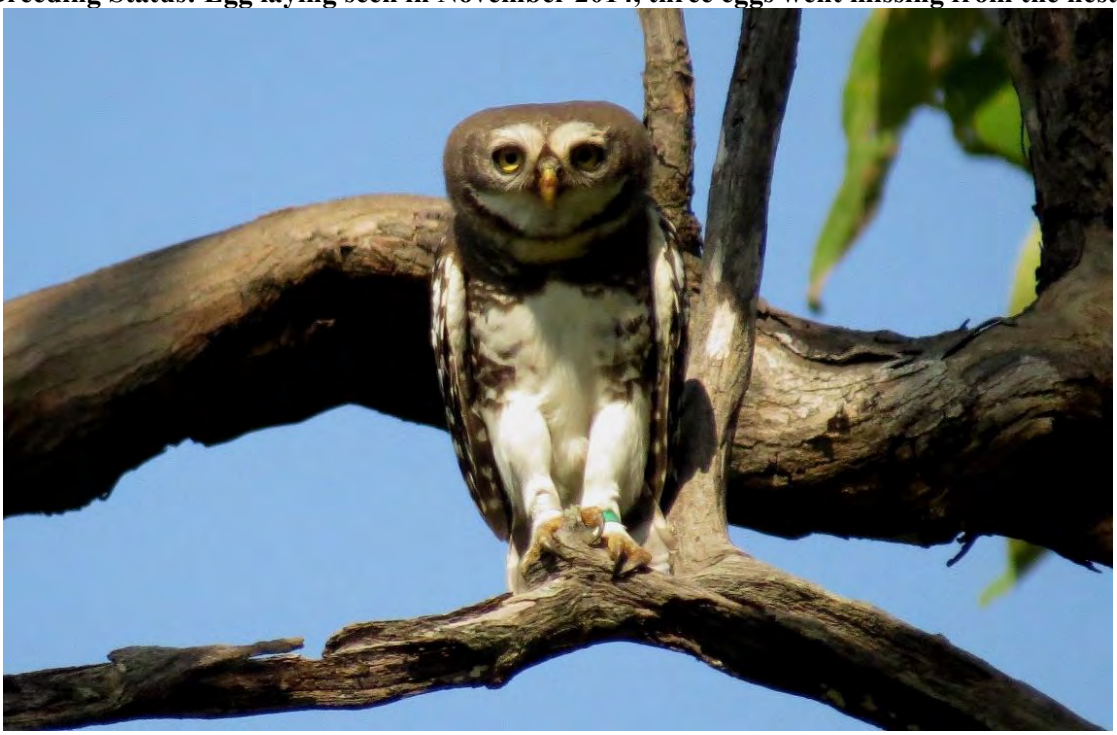
**Profile of Peerbaba Juvenile (PBJ1)**
**Location: Peerbaba-2084. Banding Date: 28-12-13**
**Breeding Status: Juvenile of PBF1 and PBM1.**



**Profile of Govindnala Male 1 (GNM1)**
**Location: Govindnala-2083 Banding Date: 1-3-14**
**Breeding Status: Paired with GNF1.**

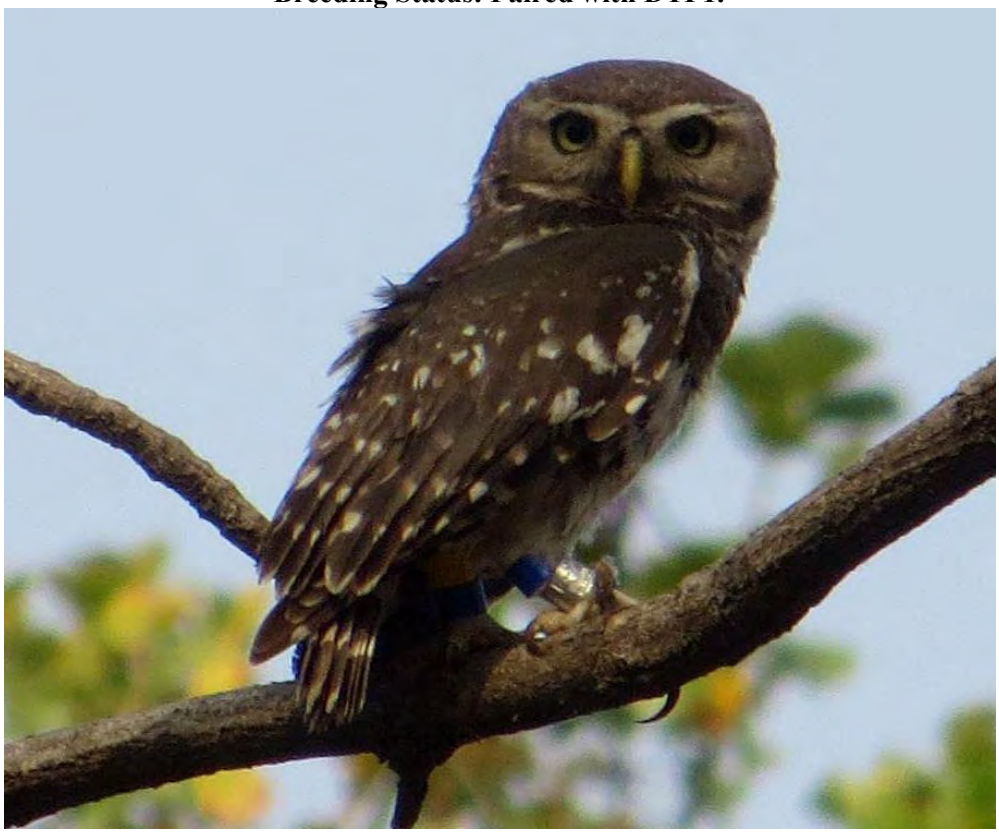
**Profile of Vikrampura Male 1(VKM1)**
**Location: Vikrampura-1948 . Banding Date: 11-4-14**
**Breeding Status: Paired with an un-banded female.**

**Profile of Jhinjari Female (JHF1)**
**Location: Jhinjri-2232. Banding Date: 8-4-14**
**Breeding Status: Egg laying seen in November 2014, three eggs went missing from the nest.**

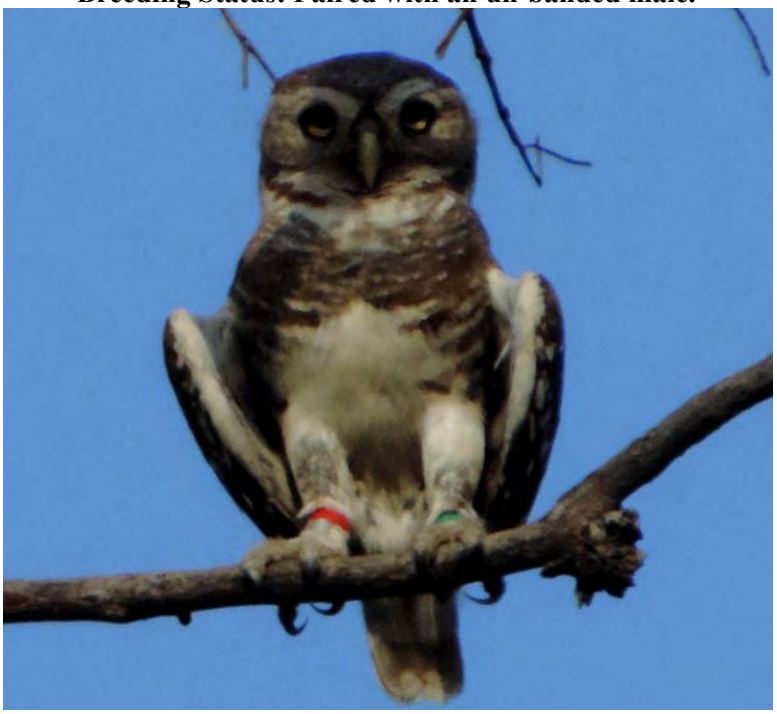


**Profile of Jhinjari Male 1(JHM1)**
**Location: Jhinjri-22332  Banding Date: 8-4-14**
**Breeding Status: Paired with JHF1.**

**Profile of 250 Turning Male (DTM1)**
**Location: Dhaiso Turning-2153. Banding Date: 9-4-14**
**Breeding Status: Paired with DTF1.**

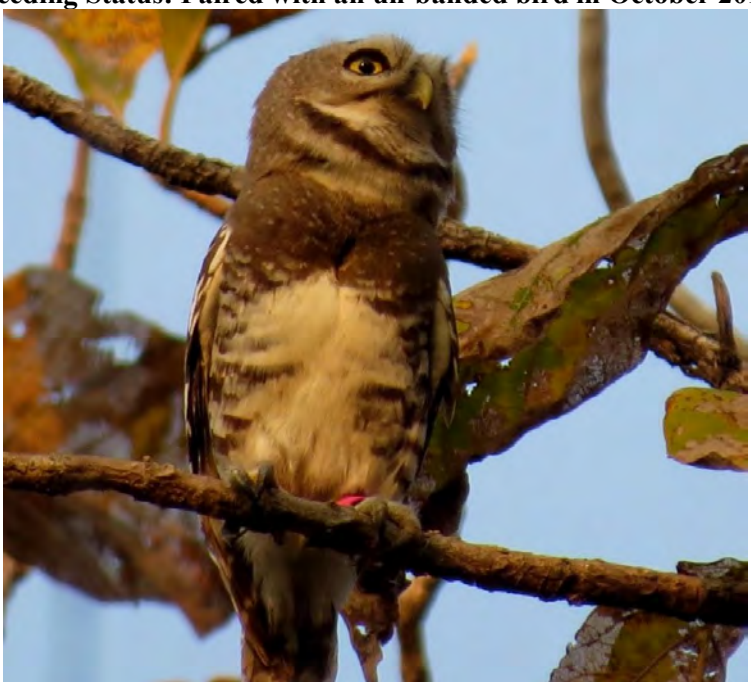


**Profile of Bagda Female 1 (BGF1)**
**Location: Bagda-2228. Banding Date: 17-2-15**
**Breeding Status: Paired with an un-banded male.**



**Profile of Harda Female 1 (HRF1).**
**Location: Harda River. West Kalibhit. Banding Date: 18-2-15**
**Breeding Status: Paired with an un-banded male.**

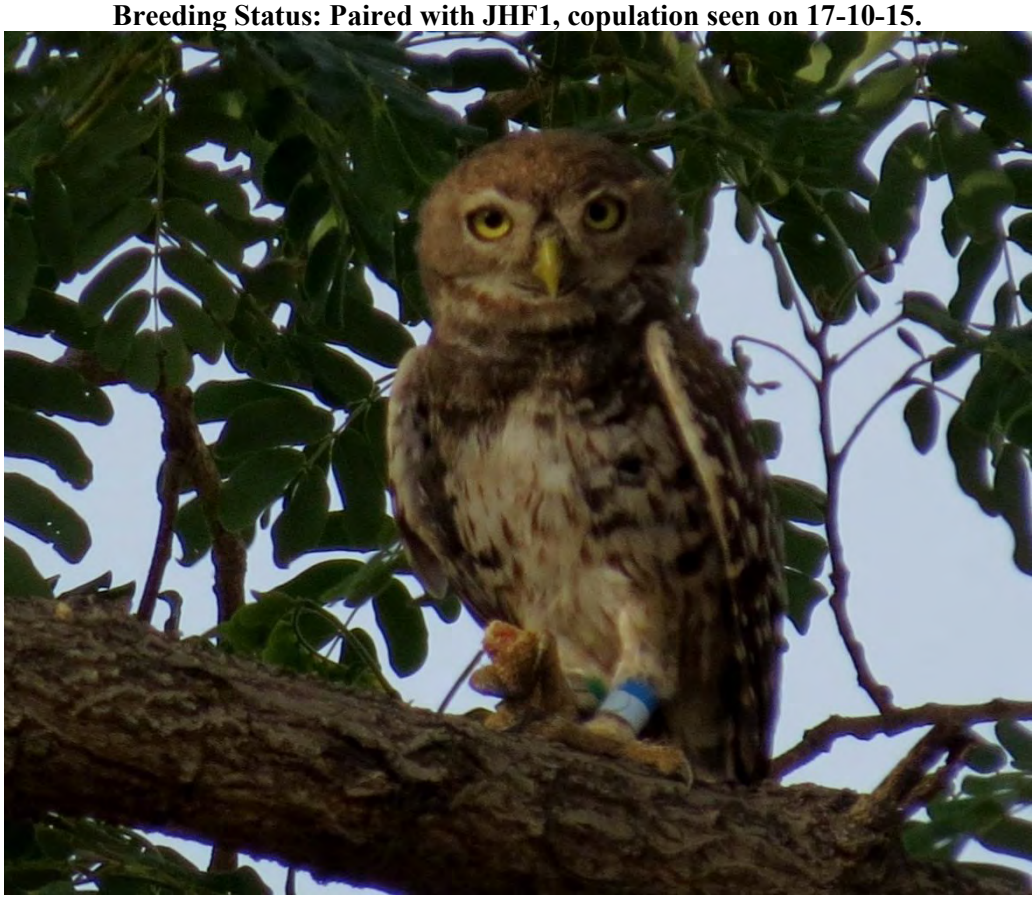
**Profile of Govindnala Female 2 (GNF2).**
**Location: Govindnala-2083. Banding Date: 9-4-15**
**Breeding Status: Paired with an un-banded bird in October 2015.**



**Profile of Jhinjari Male 3 (JHM3)**
**Location: Jhinjri-2232. Banding Date: 22-4-15**
**Breeding Status: Paired with a un-banded female.**

**Profile of Kaudi Male (KUM1).**
**Location: Kaudi-2232. Banding Date: 14-5-15**
**Breeding Status: Paired with KUF1 for three consecutive seasons, first juvenile seen outside nest on 6-1-15, second juvenile seen on 24-12-15, in 2016-2017 season egg laying was seen in December, eggs went missing from the nest.**

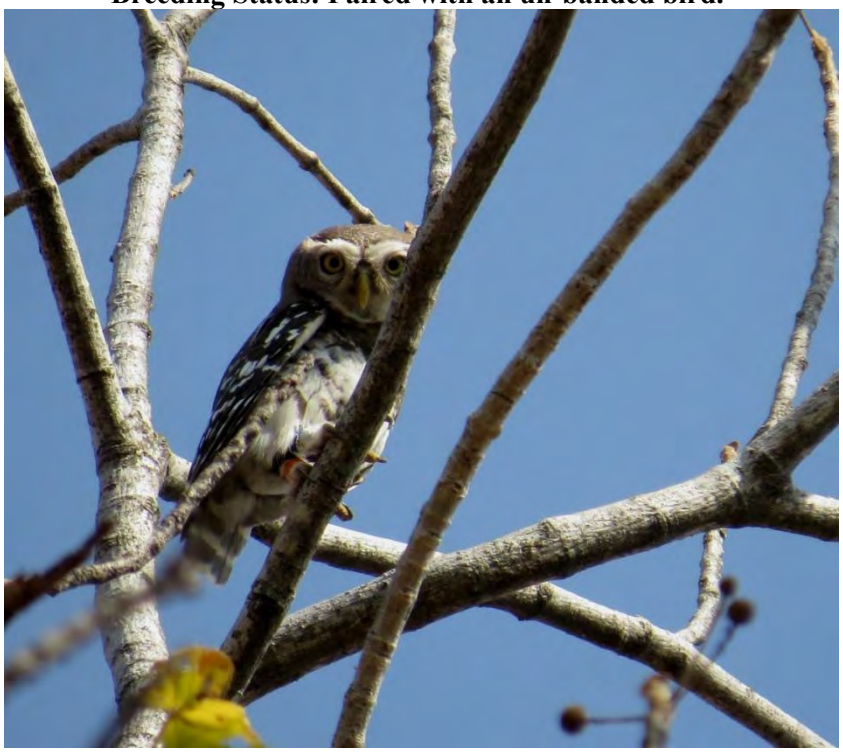
**Profile of Loodiyababa Juvenile 1(LBJ1)**
**Location: Loodiyababa-2229. Banding Date: 27-5-15**
**Breeding Status: Paired with JHF1, copulation seen on 17-10-15.**



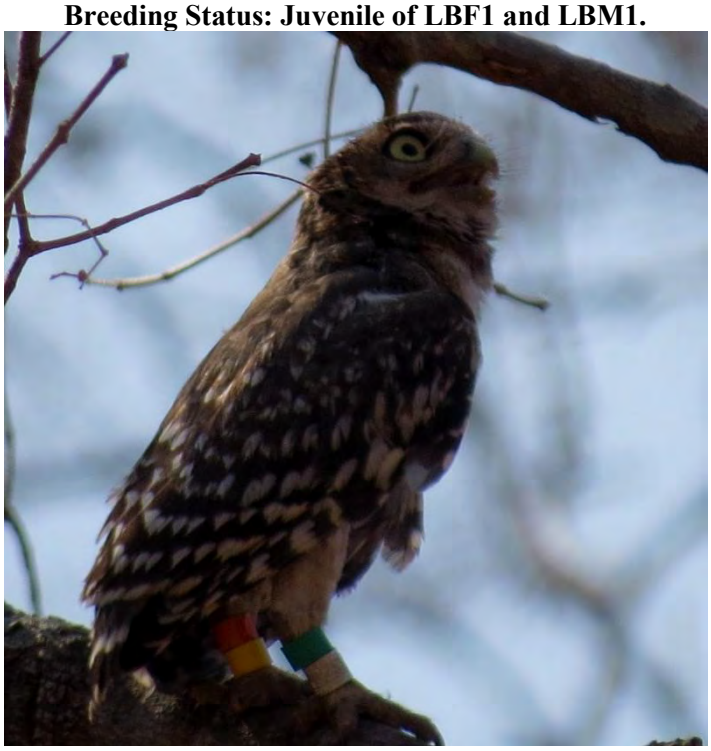
**Profile of Gogragha t Female (GGF1)**
**Location: Ghoghraghat-2016. Banding Date:28-11-15**
**Breeding status: Paired with an un-banded bird.**

**Profile of Kaudi Female 1 (KUF1).**
**Location: Kaudi-2232.. Banding Date: 17-12-15**
**Breeding Status: Paired with KUM1 for three consecutive seasons, first juvenile seen outside nest on 6-1-15, second juvenile seen on 24-12-15, in 2016-2017 season egg laying was seen in December, eggs went missing from the nest.**

**Profile of Bagda Male 1(BGM1).**
**Location: Bagda-2228. Banding Date: 17-12-15**
**Breeding Status: Paired with an un-banded bird.**

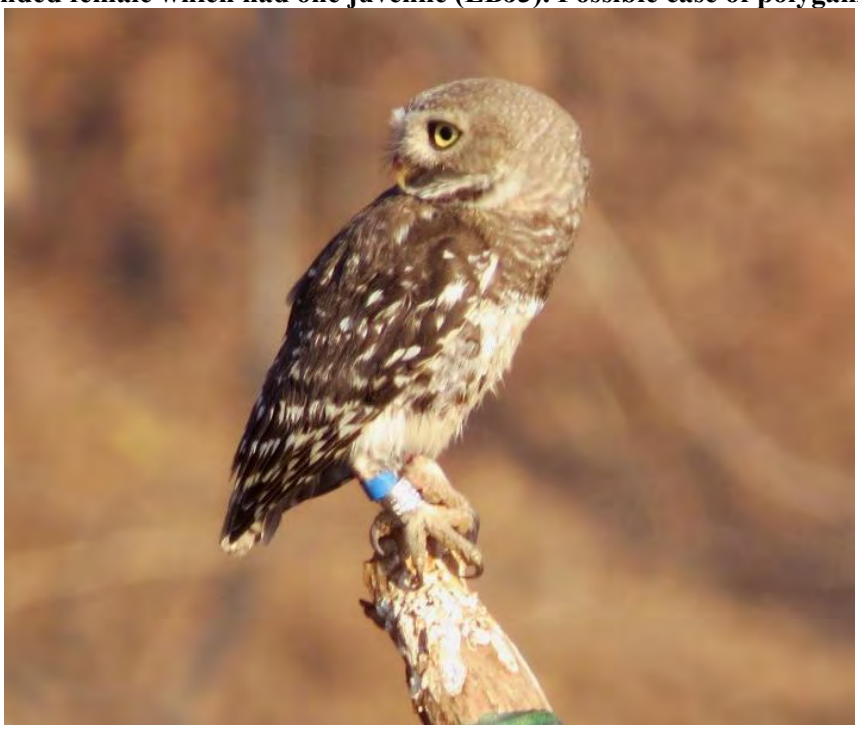


**Profile of Loodiyababa Juvenile 2(LBJ2)**
**Location: Loodiyababa-2229. Banding Date: 5-3-16**
**Breeding Status: Juvenile of LBF1 and LBM1.**

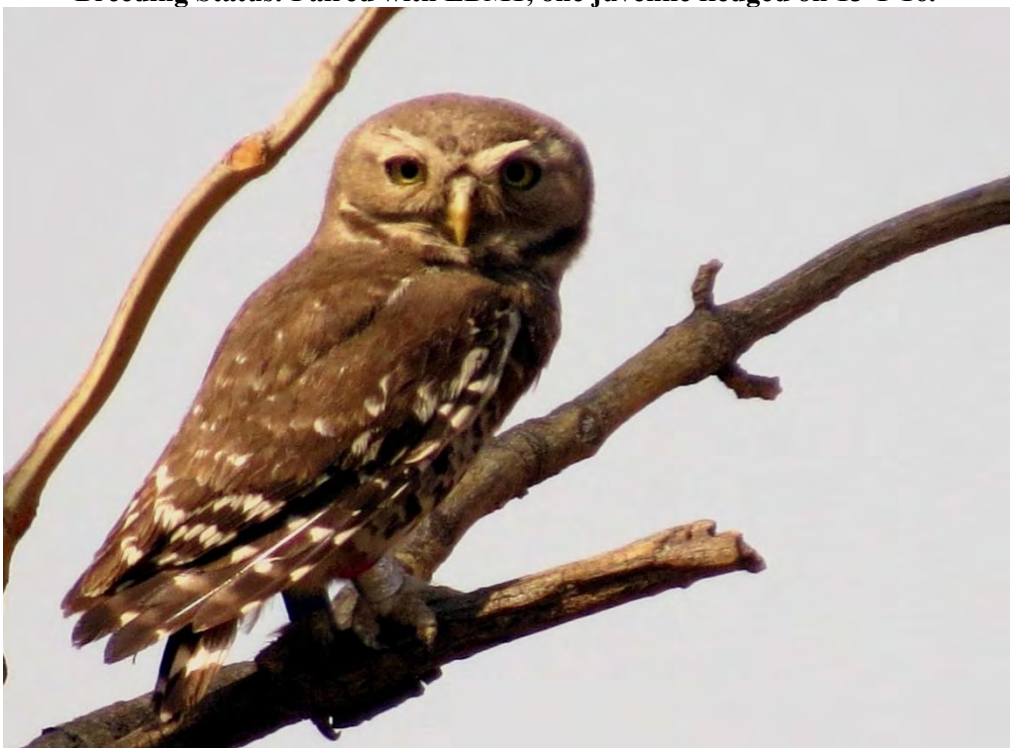


**Profile of Kekda Female 2(KDF2)**
**Location: Kekada-2153. Banding Date: 19-3-16**
**Breeding Status: Paired with an un-banded bird.**

**Profile of Lodiyabab male 1 (LBM1)**
**Location: Loodiyababa-2229. Banding Date: 24-3-16**
**Breeding Status: Paired with LBF1, one juvenile fledged on 13-1-16. In April 2016 he was seen with an un-banded female which had one juvenile (LBJ3). Possible case of polygamy.**



**Profile of Loddiyababa Female 1(LBF1)**
**Location: Loodiyababa-2229. Compt no: 590 A. Banding Date: 24-3-16**
**Breeding Status: Paired with LBM1, one juvenile fledged on 13-1-16.**

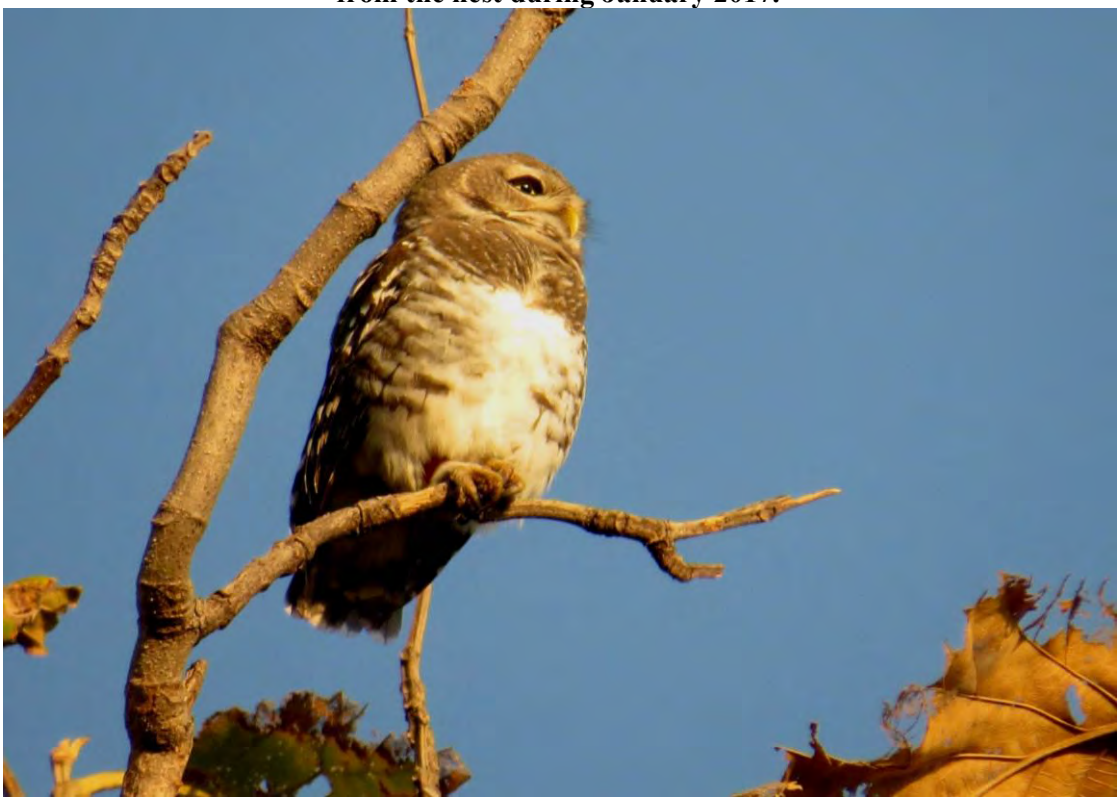


**Profile of Bagdeballa Female 1(BLF1).**
**Location: Bagdeballa-2229. Banding Date: 2-4-16**
**Breeding Status: Paired with an un-banded bird. Two juveniles were raised.**

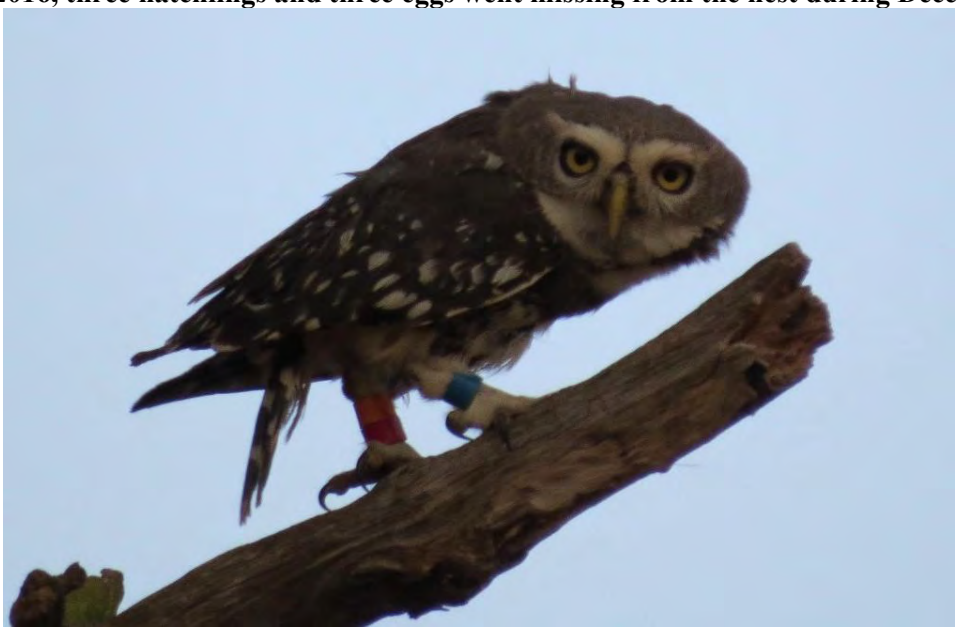
**Profile of Bagdeballa Juvenile 1(BLJ1)**
**Location: Bagdeballa-2229. Banding Date: 4-4-16**
**Breeding Status: Offspring of BLF1 and an un-banded bird.**

**Profile of Loodiyababa Juvenile 3 (LBJ3).**
**Location: Loodiyababa -2229. Banding Date: 22-4-16**
**Breeding Status: offspring of LBM1 and an un-banded bird.**

**Profile of Barajoshi Female 2 (BJF2)**
**Location: Barajoshi-2083 . BJF2 Banding Date: 22-11-16**
**Breeding Status: Paired with an un-banded male, egg laying was seen in November 2016, eggs went missing from the nest during January 2017.**



**Profile of Loodiyababa Female 2 (LBF2).**
**Location: Loodiyababa-2229. Banding Date: 26-11-16**
**Breeding Status: Paired with LBF2. Six eggs seen in the nest in November 2016, hatchlings were seen in December 2016, three hatchlings and three eggs went missing from the nest during December 2016.**



**Profile of Loodiyababa Female 2 (LBF2).**
**Location: Loodiyababa-2229 Banding Date: 9-12-16**
**Breeding Status: Paired with LBM2. Six eggs seen in the nest in November 2016, hatchlings were seen in December 2016, three hatchlings and three eggs went missing from the nest during December 2016.**

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# Chapter 5
# Recaptures of Banded Forest Owlet in the Study Area

## 5.1 Introduction

Over four years of the study we banded 50 Forest Owlet in the study area. Monitoring the banded birds provided an insight in movement pattern of the Forest Owlet. In Chapter four, we have provided information on the banding date of the bird and there after its consecutive recaptures.

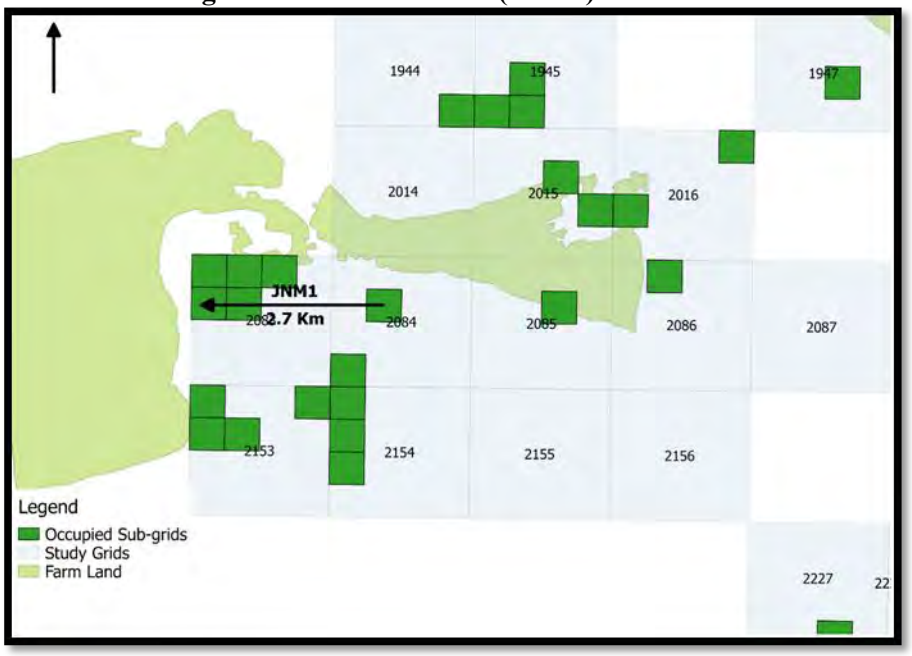
## 5.2 Methodology

Monitoring the banded birds was carried out visually with the help of binoculars and camera. Whenever a Forest Owlet was sighted, a photograph was taken. The color of bands were recorded to understand which bird was recaptured and re-sighted.

## 5.3 Results

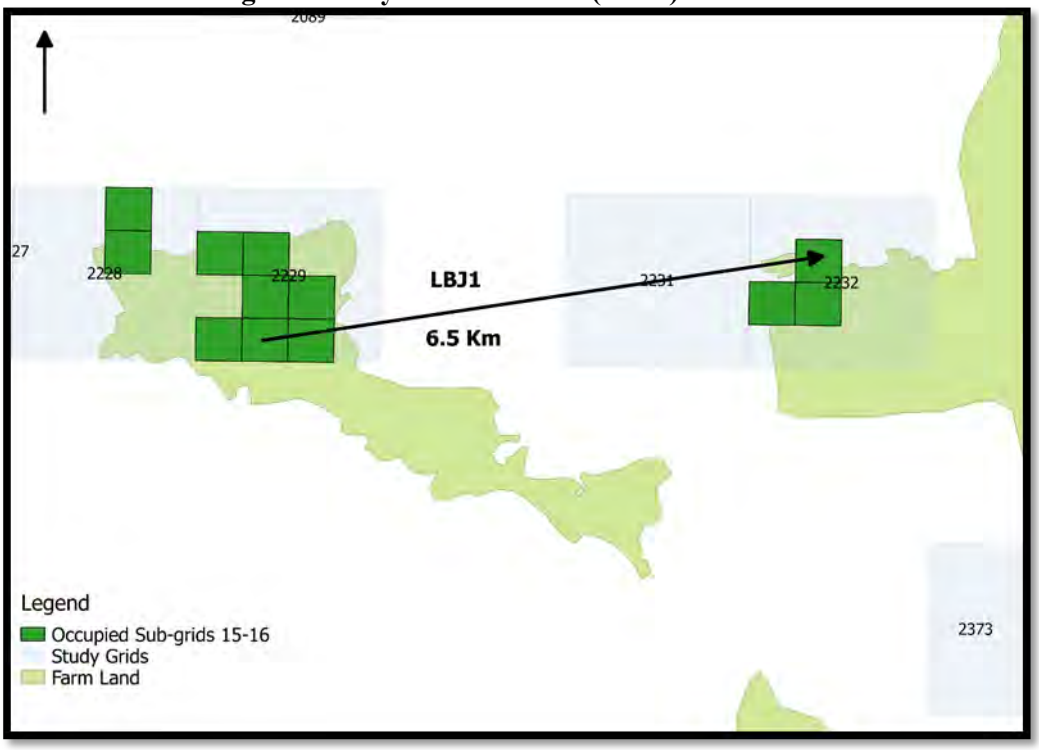
There were three cases where a banded bird has moved from one location to another within the study area. The first instance of this was seen during the 2014-2015 season. The male that was banded in 2084-Peerbaba in the Jamun-nala (32626) location had moved 2.7 km to the Barajoshi (32621) location in the 2083-Kuanala grid. During that period, the Barajoshi location was occupied by BJF1.

**Fig 5.1 Jamun Nala Male (JNM1) Movement**




The second such instance of movement of banded birds was that of the Juvenile banded in the 2229 (Loodiyababa) grid. The juvenile had moved 6.5 km from the Loodiyababa location (35416) to the Jhinjri location (34874) in the 2232-Jhinjri grid. This was the largest movement of any Forest Owlet that we have seen in the three-year study. The Juvenile had moved to the new location and paired with JHF1 which was occupying the location. Through this we were able to determine the sex of the juvenile as a male. We had also seen copulation between the pair on the 17$^{th}$ of October 2015. LBJ1 stayed in the location till the month of December. Although copulation was seen there was no nesting that took place in the location. Post December LBJ1 was missing from the location.

**Fig 5.2 Loodiyababa Juvenile (LBJ1) Movement.**




The third movement of a banded bird was by GNF2. This bird moved from the Govindnala (32344) location in the 2083- Kuanala grid to the Kekada (33729) location in the 2153- Dhaiso Turning grid. This female moved 2.5 km to the kekada location. Here it paired with an un-banded male. GNF2 was present in the location till the 9th of January. After which the location was occupied by an un-banded pair.

*Prachi Mehta/WRCS*

Fig. 5.3 Govindnala Female 2 (GNF2) Movement.

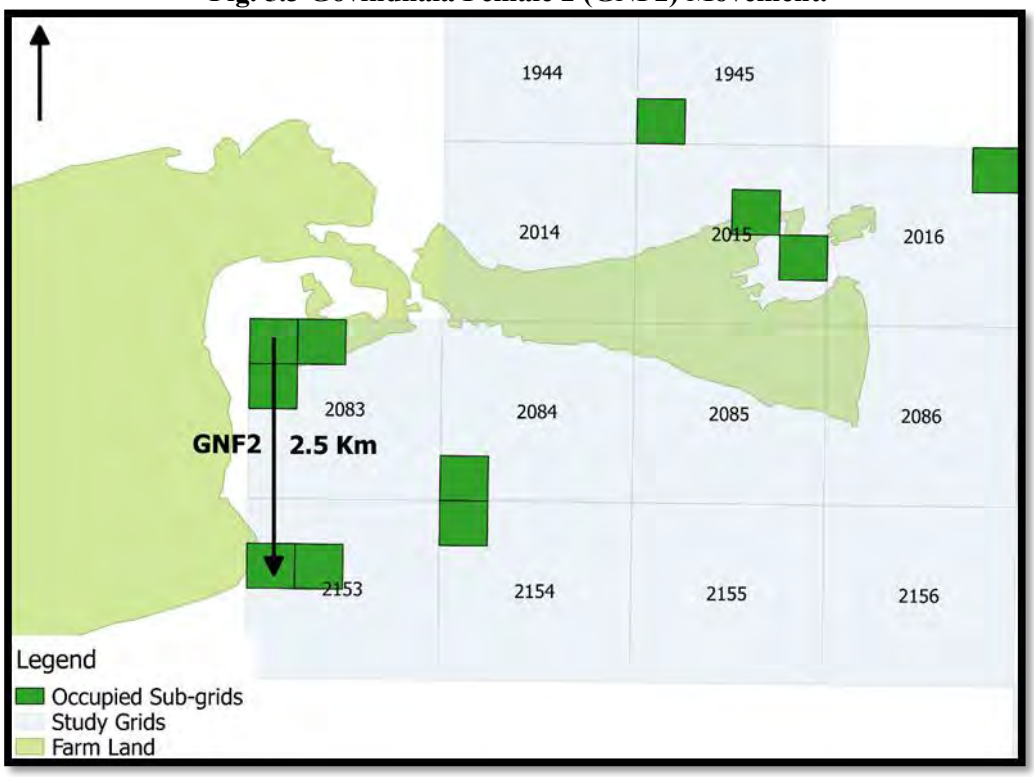
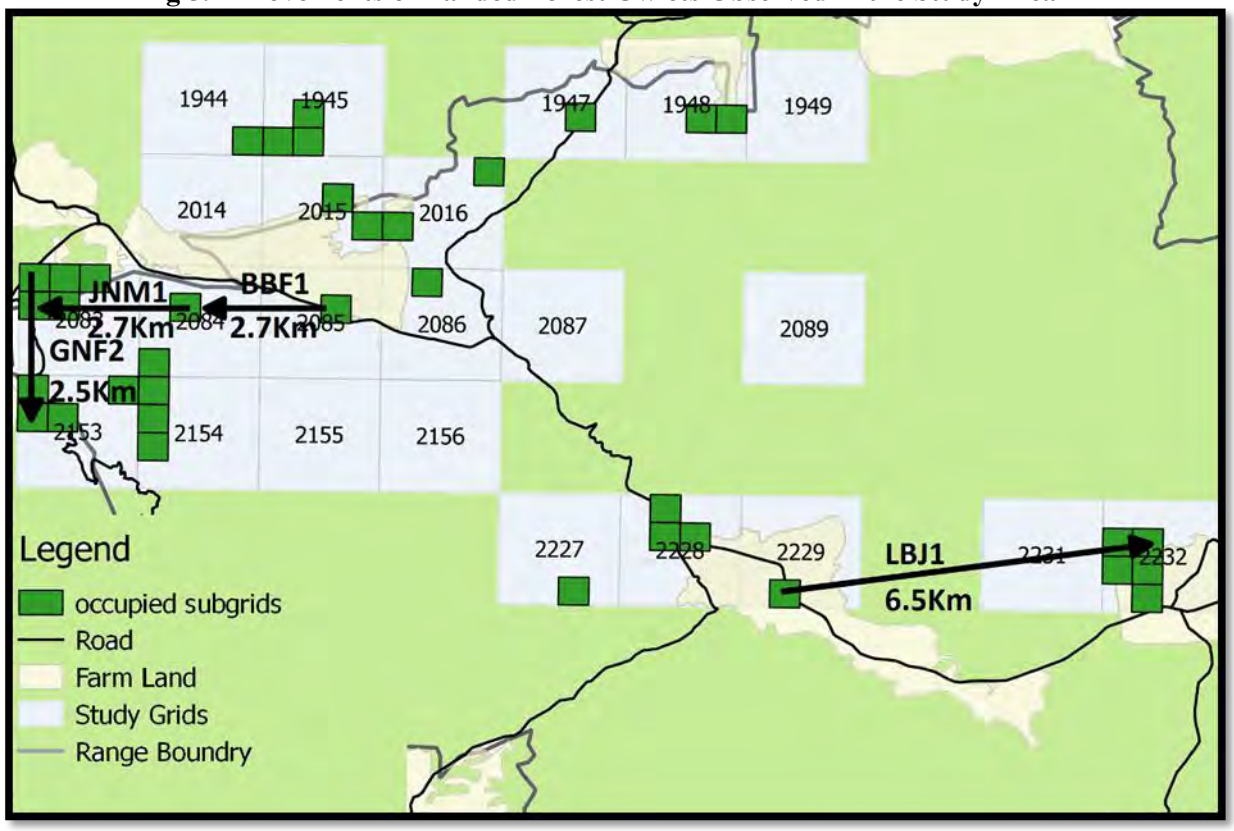



Fig 5.4 Movements of Banded Forest Owlets Observed in the Study Area



Apart from the three instances, we observed the following with the banded birds:

- Forest Owlets continue to occupy their territoires till Monsoon.
- Post-monsonn, a few birds would continue to occupy the same area while others did not return to their original sites.
- Some birds that were banded in the first year, continue to occupy the area for all three years.
- Banded juveniles dispered and there were not many recaptures of the juveniels.
- Each season, we observed a few unbanded birds in the area. This indicates that the Forest Owlet have localized movement patterns.

*Prachi Mehta/WRCS*

## Table 5.1 Details of Recaptures of Banded Birds in the Study Area

| Sr. No. | Banding Date | Banding Location | Banding Code | Location in 13-14 | Location in 14-15 | Location in 15-16 | Location in 16-17 | Remark |
|---|---|---|---|---|---|---|---|---|
| **1** | 07-10-2013 | 250 Turning(2153) | DTF1 | 250 Turning-Kekada | 250 Turning-Kekada | NA | 250 Turning-Kekada | Bird retained territory. Present for 3 years after banding. |
| **2** | 10-12-2013 | Bhag Pura- 2014 | BPF1 | Bhagpura | NA | NA | NA | |
| **3** | 28-12-2013 | Peer Baba-2084 | PBJ1 | Peerbaba | NA | NA | NA | |
| **4** | 04-01-2014 | Banda Baba-2085 | BBJ1 | Bandababa | NA | NA | NA | |
| **5** | 25-02-2014 | Kua Nala-2083 | KNM1 | Kuanala | Kuanala | NA | NA | Territory retained. Present for 2 years after banding. |
| **6** | 25-02-2014 | Bhajudana | BDM1 | Bhajudana | NA | NA | NA | |
| **7** | 25-02-2014 | Kher Baba- 1873 | KBM1 | Kherbaba | Kherbaba | NA | Kherbaba | Territory retained Present for 3 years after banding. |
| **8** | 26-02-2014 | Barajoshi- 2083 | BJM1 | Barajoshi | | | | Bird died in Road Kill in the 2nd year. |
| **9** | 26-02-2014 | Mehlu Road- 2086 | MRF1 | Mehlu Road | NA | NA | NA | |
| **10** | 28-02-2014 | Jhanda baba- 2084 | JBF1 | Jhandababa | NA | NA | NA | |
| **11** | 28-02-2014 | Jamun Nala- 2084 | JNM1 | Jamunala | Barajoshi | NA | NA | Bird moved Present for 2 years after banding. |
| **12** | 01-03-2014 | Govind Nala-2083 | GNM1 | Govindnala | NA | NA | NA | |
| **13** | 01-03-2014 | Govind Nala-2083 | GNF1 | Govindnala | NA | NA | NA | |
| **14** | 01-03-2014 | 250 Turning-2153 | DTJ1 | 250 Turning-Kekada | NA | NA | NA | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **15** | 02-03-2014 | Mehlu Road- 2086 | MRM1 | Mehlu Road | Bhagpura | NA | NA | Bird moved. Present for 2 years after banding. |
| **16** | 02-03-2014 | Lokad Gogra-2154 | LGF1 | Lokadgogra | Lokadgogra | NA | NA | Retained territory. Present for 2 years after banding. |
| **17** | 03-03-2014 | Jamun Nala- 2084 | JNF1 | Jamunala | NA | NA | NA | |
| **18** | 03-03-2014 | Peer Baba-2084 | PBM1 | Peerbaba | Peerbaba | Jhandababa | Jhandababa | Bird moved to another location in the same grid. 200 m distance. |
| **19** | 08-04-2014 | Jhinjari- 2232 | JHF1 | Jhinjri | NA | Jhinjri | Jhinjri | Retained territory. Present for 3 years after banding. |
| **20** | 08-04-2014 | Jhinjari- 2232 | JHM1 | Jhinjri | NA | NA | NA | |
| **21** | 09-04-2014 | 250 Turning-2153 | DTM1 | 250 Turning-Kekada | NA | NA | NA | |
| **22** | 11-04-2014 | Vikrampura-1949 | VKM1 | Vikrampura | NA | NA | NA | |
| **23** | 16-04-2014 | Jhanda baba- 2084 | JBM1 | Jhandababa | NA | NA | NA | |
| **24** | 18-04-2014 | Jhinjari- 2232 | JHM2 | Jhinjri | Jhinjri | NA | NA | Retained Territory. Present for 2 years after banding. |
| **25** | 17-12-2014 | Kekada- 2153 | KDF1 | NA | kekada | NA | NA | Retained territory. Present for 2 years after banding. |
| **26** | 17-02-2015 | Bagda- 2228 | BGF1 | NA | Bagda | NA | NA | Retained territory. Present for 2 years after banding. |
| **27** | 18-02-2015 | Harda river-West Kalibhit | HRF1 | NA | Harda River | NA | NA | |
| **28** | 09-04-2015 | Govind Nala-2083 | GNF2 | NA | Govindnala | Kekada | NA | Bird moved. Present for 2 years after banding. |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **29** | 11-04-2015 | Kula Bura- 1945 | GRF1 | NA | Kula Bura | NA | NA | Present for 1 year after banding. |
| **30** | 16-04-2015 | Kaudi- 2232 | KUJ1 | NA | Kaudi | NA | NA | |
| **31** | 17-04-2015 | Kua Nala-2083 | KNF2 | NA | Kuanala | NA | NA | |
| **32** | 22-04-2015 | Jhinjari- 2232 | JHM3 | NA | Jhinjri | NA | NA | |
| **33** | 14-05-2015 | Jhinjari- 2232 | KUM1 | NA | Kaudi | Kaudi | Kaudi | Bird Retained territory. Present for 2 years after banding. |
| **34** | 27-05-2015 | Ludiyababa- 2229 | LBJ1 | NA | Ludiyababa | Jhinjri | NA | |
| **35** | 28-11-2015 | Ghoghraghat-2016 | GGF1 | NA | NA | Gograghat | NA | |
| **36** | 17-12-2015 | Kaudi- 2232 | KUF1 | NA | NA | Kaudi | Kaudi | Bird retained territory. Present for 2 years after banding. |
| **37** | 17-12-2015 | Bagda- 2228 | BGM1 | NA | NA | Bagda | Bagda | Bird retained territory. Present for 2 years after banding. |
| **38** | 05-03-2016 | Ludiyababa- 2229 | LBJ2 | NA | NA | Ludiyababa | NA | |
| **39** | 19-03-2016 | Kekada- 2153 | KDF2 | NA | NA | Kekada | Kekada | Bird retained territory. Present for 1 year after banding. |
| **40** | 24-03-2016 | Ludiyababa- 2229 | LBM1 | NA | NA | Ludiyababa | Ludiyababa | Bird retained territory. Present for 1 year after banding. |
| **41** | 24-03-2016 | Ludiyababa- 2229 | LBF1 | NA | NA | Ludiyababa | NA | |
| **42** | 02-04-2016 | Bagdeballa- 2229 | BLF1 | NA | NA | Bagdeballa | NA | |
| **43** | 04-04-2016 | Bagdeballa- 2229 | BLJ1 | NA | NA | Bagdeballa | NA | |
| **44** | 22-04-2016 | Ludiyababa- 2229 | LBJ3 | NA | NA | Ludiyababa | NA | |
| **45** | 22-11-2016 | Barajoshi- 2083 | BJF2 | NA | NA | NA | Barajoshi | Bird retained |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | territory. Present for 1 year after banding. |
| **46** | 26-11-2016 | Ludiyababa- 2229 | LBM2 | NA | NA | NA | Ludiyababa | Bird retained territory. Present for 1 year after banding. |
| **47** | 09-12-2016 | Ludiyababa- 2229 | LBF2 | NA | NA | NA | Ludiyababa | Bird retained territory. Present for 1 year after banding. |

**NA indicates no information.**

Prachi Mehta/WRCS

# Chapter Six
# Diet of Forest Owlet

## 6.1 Introduction

Information on the diet of a species is of paramount ecological importance as it can provide insights in to the prey spectrum of the species, the foraging habitat and hunting mode of the raptor and its diel patterns. Also, diet studies help in understanding prey distribution, prey availability and prey abundance in the area (Marti 1987).

Diet studies are carried out using following methods

- Gut Content Analysis: This method is used mainly for fishes where the oesophagus is squeezed to eject the food remains which is examined to assess the prey eaten. Also in case, a dead specimen is obtained then the gut contents are removed and analyzed for prey consumed. However, this method is cumbersome and requires the analysis to be done before the food is digested in the stomach (Marti 1987, Yalden 2009).
- Direct Observation of prey consumed: Observing the type of prey consumed is a reliable method in determining the diet of a species. However, this method has limitations as it is difficult to observe species that are nocturnal or elusive. Also the observation needs to be round the clock so as to document all feeding events which makes it logistically difficult. To circumvent this issue, camera traps and videography is used to document the feeding habits of the species. This has by far revealed the most exact information on the diet of the species. However, at times it may not be possible to deploy many camera for a long duration.
- Faecal or Pellet Analysis : Most researchers analyze scats or pellets to study the diet of a species. Pellets or scats can be collected easily without intrusion to the species and analysed and studied relatively easily compared to other methods. The method of identifying prey remains from pellets and scats is fairly well established thus helping in assessing the diet of the species. However, remains found in the pellets are often broken so it may not help in identifying the prey up to the species level. Nonetheless, considering the logistics and ease of working with the pellets/scats, it remains one of the most popular methods of diet analysis.

The diet of Forest Owlet has been documented by two studies, both from Toranmal Reserved Forests in Maharashtra. Ishtiaq and Rahmani (2000) observed male Forest Owlets delivering prey to the females at the nests. The major prey items delivered were 57. 5 % reptiles and 15.7 % rodents and the remaining were birds, amphibians and invertebrates. Jathar et al. (2005) analysed 193 pellets of Forest Owlets over a period of four years and reported that the major diet of the Forest Owlet comprised of 41 % insects, followed by 34% small mammals, and 16 % reptiles.

**Forest Owlet Ejecting a Pellet**

*Prachi Mehta/WRCS*

**Pellets of different owl species varies in dimension**


*Akshay Anand/WRCS*

## 6.2 Methodology

We collected the regurgitated pellets of the Forest Owlet from below its roost and nest sites. The pellets were collected from October to June each year. Each pellet was stored in a separate zip lock bag and labelled mentioning the date, location and bag number.

The pellets were sun-dried in the field to prevent fungal growth. Prior to analysis, the pellets were weighed on an electronic scale at IISER, Pune. We measured the width and length of the pellets with vernier calliper.

After the measurements, the pellets were dissected to study the prey remains. Each pellet was soaked in water for a few minutes before dissection to soften the hard portions of hair and fur. The pellet were gently dissected using a forcep and needle to separate out the indigestible remains including skull, dentition, bones, beaks, feathers, elytra, and other parts. The prey remains were classified according to their taxa and stored in separate bags for identification and quantification (Yalden 2009)

## 6.3 Prey Identification

For the initial period, we took help of subject experts for training us in identifying the prey remains. Dr. S.S. Talmale, Scientist, Zoological Survey of India(ZSI, Jabalpur) imparted training in identifying small mammal remains. Dr. Talmale trained us in identification of rodents and shrews from owl pellets. For identifying invertebrate and bird remains, we consulted Dr. Pankaj Bhatnagar, Scientist , ZSI Pune, Professor Hemant Ghate, Head Zoology Department, Modern College, Pune and Dr. Krushnamegh Kunte , Scientist, National Center for Biological Sciences, Bangalore. We could identify bird talons, reptiles and amphibians with the help of available literature and photographs. For mammals we referred to Talmale and Pradhan (2009).

## 6.4 Prey Quantification

For quantifying mammalian prey, number of skulls and paired dentitions were counted. For birds, tarsus, beak, sternum were counted. For reptiles, number of paired dentitions were considered. For invertebrates, we counted number of legs, wings, heads, mouth parts and stings.

**Juvenile Forest Owlet set to hunt**

*Prachi Mehta/WRCS*

**Dissection of pellet (left) and remains of mammalian prey (left)**

*WRCS*

**Insect remains**

**Reptile Remians**

**Bird Remains**

**Amphibian Remains**

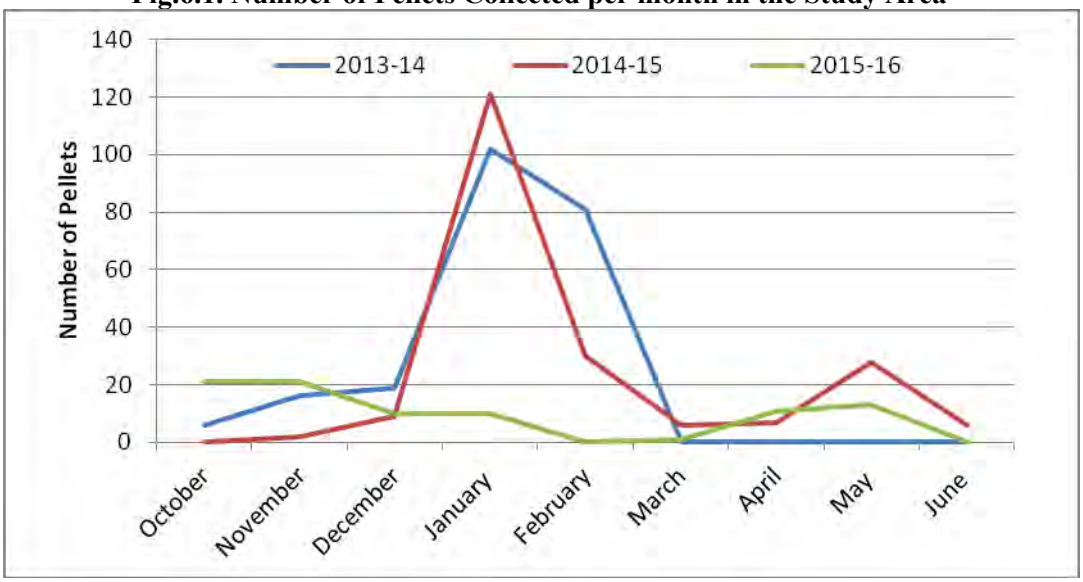
**Mammal vertebrate**

*WRCS*

**Table 6.2 Number of Forest Owlet Pellets and Prey Remains**

| | 2013-14 | 2014-15 | 2015-16 | TOTAL |
|---|---|---|---|---|
| No. of Pellets | 230 | 209 | 87 | 526 |
| No. of Prey Remains | 619 | 517 | 300 | 1436 |

**Fig.6.1. Number of Pellets Collected per month in the Study Area**




## 6.5 Diets of Sympatric Forest, Spotted and Jungle Owlet

*Prachi Mehta/WRCS*

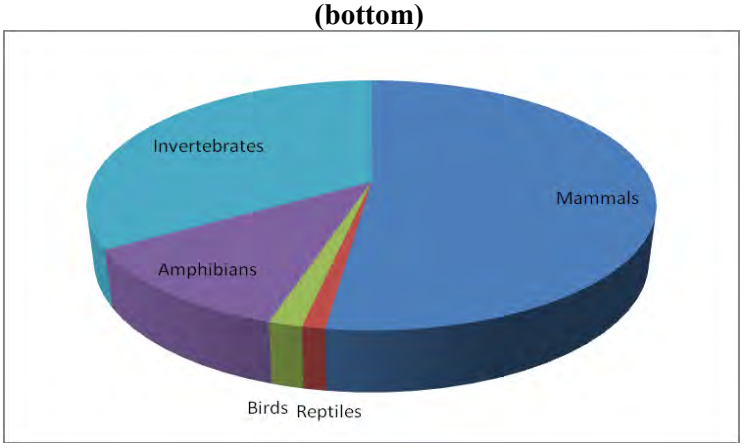
Forest Owlet is co-occurring in the same habitat as the wide spread Spotted Owlet (*Athena brama*), and the Jungle owlet (*Glaucidium radiatum*). We compared the diet of three species to understand the differences and similarity in their diet composition.

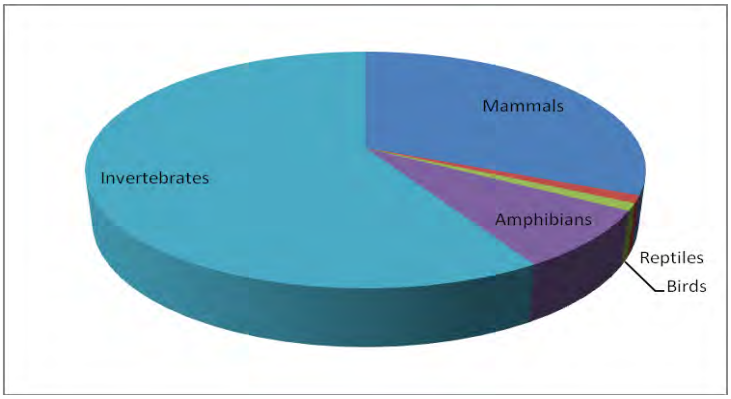
From October 2013 to February 2014, we collected regurgitated pellets of forest owlet (230), spotted owlet (110) and jungle owlet (38) in the study area. The prey remains were separated, identified and quantified to construct the diet profile of the Forest Owlet and compared with that of the Spotted and Jungle Owlet.

## 6.6 Results

A total of 1164 prey items were analyzed from 370 pellets. The prey per pellet differed between the forest owlet (2.7 ±1.91), spotted owlet (3.7 ±2.6) and the jungle owlet (4.47±5.7) indicating that the Jungle Owlet preyed on small sized prey compared to the other two owls.

**Percent Prey in the diet of Forest Owlet (top), Spotted Owlet(middle) and Jungle Owlet (bottom)**



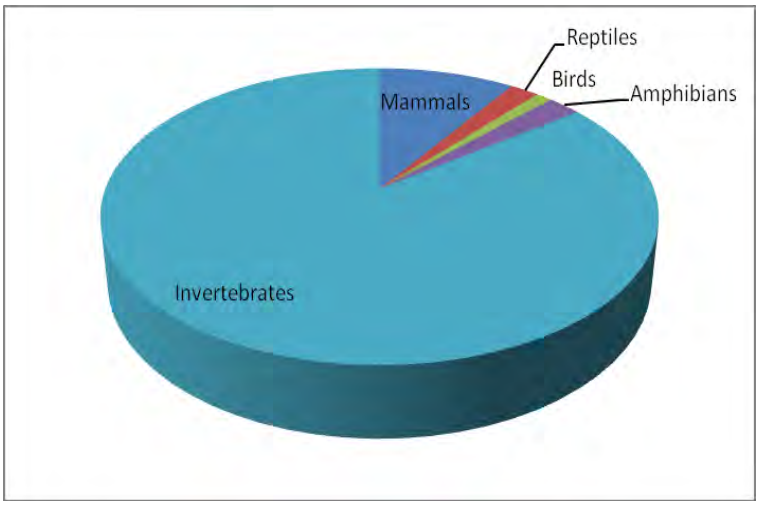



**Fig: 6.2 Comparison of Percent Prey Frequencies in the diet of Forest, Spotted and Jungle Owlet**

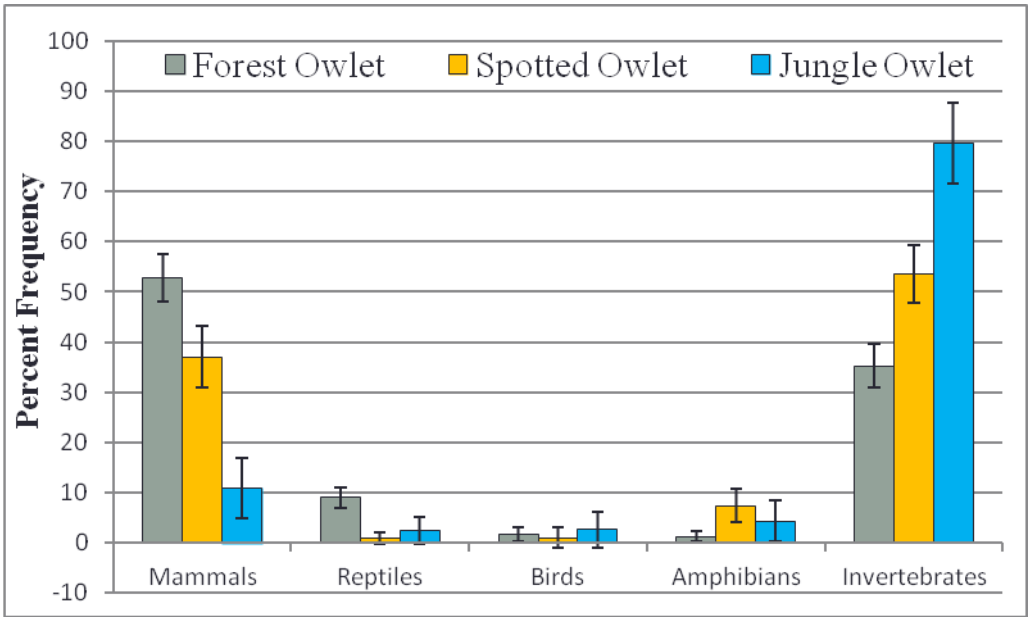
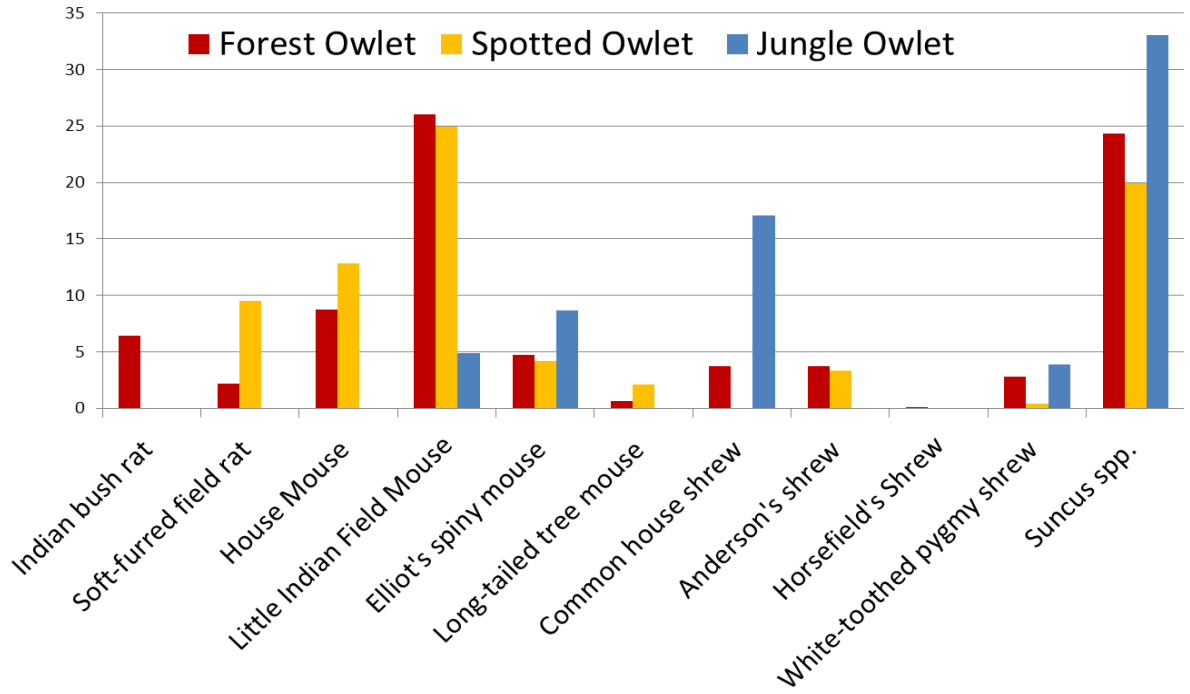
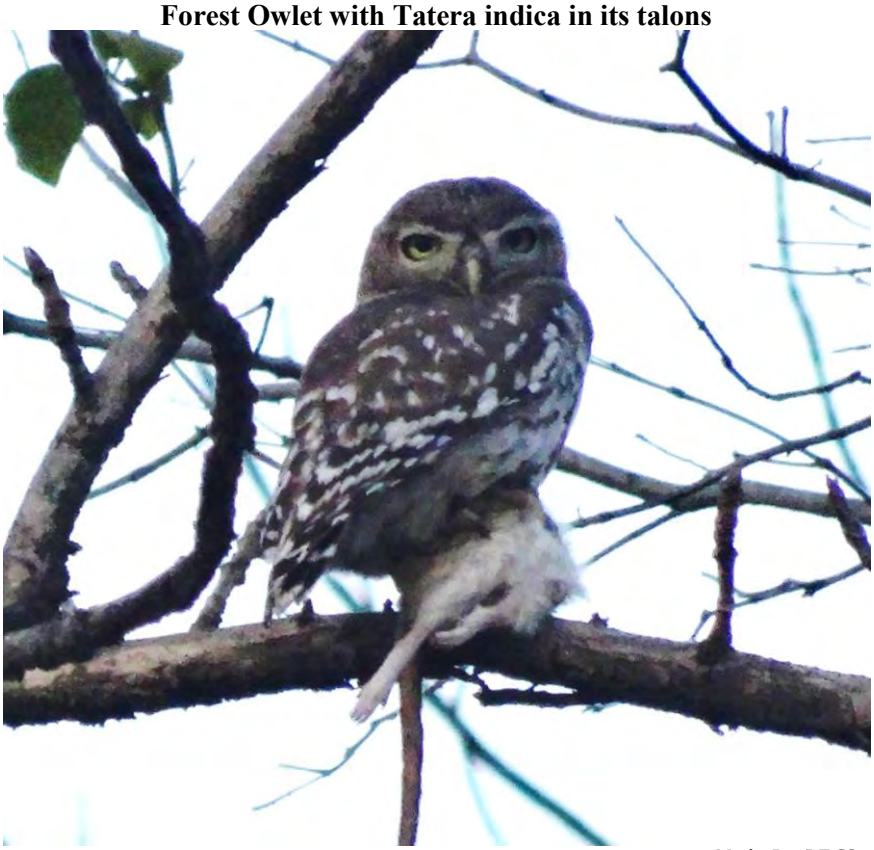



**Fig: 6.4. Percent Biomass Contribution of Mammal species in the diet of Forest, Spotted and Jungle Owlet**




Forest Owlets feed mainly on vertebrate prey while both the other two owlets prey on large number of the invertebrate prey. The forest owlet and the spotted owlet frequently consumed the Indian field mouse *Mus booduga*, the house mouse *Mus musculus* and the white-toothed pygmy shrew *Suncus etruscus* while the Jungle fed on small sized mammals.

**Forest Owlet with Tatera indica in its talons**



*Megha Rao/WRCS*

Mammals contributed to the maximum biomass in all three owlets. We used 10000 bootstrap simulations on prey frequencies and prey biomass to generate mean prey frequencies, mean biomass for species, mean biomass of taxa and number of prey items per pellet with 95 % confidence intervals. To understand the spectrum of individual owlet's diet, we computed the prey diversity, evenness and niche-breath using Shannon-Wiener (H'), Simpson (J) and Levin's ($B_A$) index respectively.

**Sub-adult Forest Owlet with a reptile**

*Prachi Mehta/WRCS*

**Table 6.3: Mean Prey Biomass in the diet of Forest owlet, Spotted owlet and Jungle Owlet**

| | | Forest Owlet | Spotted Owlet | Jungle Owlet |
|---|---|---|---|---|
| **Mean Biomass taxa-wise** | | n=230 | n=110 | n=38 |
| **Rodents and Shrews** | Mean % | 73 | 68 | 36 |
| | 95% CI | 67-78 | 59 -77 | 21-50 |
| | Variance | 8.4 | 21.1 | 60.7 |
| | SD | 2.9 | 4.6 | 8 |
| **Reptiles** | Mean % | 27 | 4 | 8 |
| | 95% CI | 21-32 | 1 to 8 | 0 to 18 |
| | Variance | 8.6 | 3.8 | 19.1 |
| | SD | 2.9 | 2 | 4.3 |
| **Birds** | Mean % | 3 | 1 | 5 |
| | 95% CI | 0.8 -5 | 0-3 | 0 to 13 |
| | Variance | 1.2 | 0.9 | 13 |
| | SD | 1.1 | 1 | 3.5 |
| **Amphibians** | Mean % | 3 | 20 | 10 |
| | 95% CI | 1.3 to 6 | 12 to 27 | 3 to 21 |
| | Variance | 1.4 | 15.5 | 24 |
| | SD | 1.2 | 3.9 | 5 |
| **Invertebrates** | Mean % | 58 | 84 | 88 |
| | 95% CI | 52 -65 | 76-91 | 76 to 97 |
| | Variance | 10.4 | 13.3 | 28 |
| | SD | 3.2 | 3.6 | 5.3 |

**Table 6.4 Prey diversity, evenness and niche breadth of three owlets in the study area**

| | Forest Owlet | Spotted Owlet | Jungle Owlet |
|---|---|---|---|
| **No. of pellets** | 230 | 110 | 38 |
| **Total Prey Remains** | 619 | 375 | 170 |
| **Diversity (H')** | 2.67 | 2.16 | 1.53 |
| **Evenness (J)** | 0.81 | 0.70 | 0.58 |
| **Niche-breadth ($B_A$)** | 0.32 | 0.35 | 0.44 |

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# Chapter Seven
# Nest Site Selection and Breeding Status of Forest Owlet

## 7.1 Introduction

Habitat selection by a species can be based on its geographical distribution, food preference and availability of suitable nesting sites (Forsman et al. 1996). Within a landscape, a species may choose the microhabitat and select nesting habitat and nest trees with specific parameters. Survival of a species is linked to its breeding success therefore selecting a safe and suitable nest is vital for its continued existence. Our study examined the nest site selection and nest tree parameters of the Forest Owlet in the study area. Along with the Forest Owlet, we also examined the nest site selection of widely distributed Spotted Owlet and Jungle Owlet to understand if there is any overlap among them in selecting nesting habitat

## 7.2 Methodology

### Establishing the Status of the Breeding Pair

The breeding season of the Forest Owlet begins from October onwards. Like in other owl species, all Forest Owlet pairs may not breed or nest each year. To determine the nesting status of a pair, we monitored the pair carefully to observe the signs of pair formation (Forsman et al 1996, Reid et al. 1996).

Following behavior in the Forest Owlet indicates that the pair is most likely to nest:

- Male and female are sitting in close proximity to each other either on the same tree or/and on the branch.
- Male brings a mouse for the female and prey is exchanged.
- The female accepts the mouse and consumes it or cashes it in a cavity for later use.

**Forest Owlet Pair at Barajoshi**

*Akshay Anan d /WRCS*

**Prey Exchange at LoodiyaBaba**

*Akshay Anand/WRCS*

**Forest Owlet Nest Site at Jhinjari**

*Prachi Mehta//WRCS*

## 7. 3 Nest Site Characteristics

The pair status is confirmed when the prey is exchanged. The pair is monitored closely during this period to locate the nest site. From 2013 to 2107, we located totally 15 nests in the study area. A 20mX20m square plot was marked with the nest tree at the centre. In addition to that four 20mX20m plots were laid in four different directions at an average distance of 150m from the nest tree.

The following parameters were recorded at each of the above plots.

- Altitude and GPS coordinates of the centre nest tree
- Tree Species
- Tree GBH (> trees greater than 10cm girth)
- Tree height was measured using a clinometer
- Ground cover data: Four 1 X 1m plots were laid randomly inside each of the 20mX20m plots and the following was recorded, percentage of bare soil, litter and grass cover.  Canopy cover-
- Canopy cover: A densitometer was used to measure canopy cover d at four random points in each of the 20X20m plots. Percent canopy cover was calculated using the following formula: No. of points reflecting canopy X 1.04. An average score was calculated for each of the nest and non-nest site plots Biotic Pressures : Within 20 x 20 m plot, we counted the following:
- Number of trees logged
- Number of trees lopped
- Number of trees cut
- Signs of Forest Fire
- Number of cattle seen and dung cakes counted

**Table 7.1 Details of Forest Owlet Nest (N=17) locations in the Study Area**

| Grid No. | Location Name | Altitude (m) | Nest Tree Species |
|---|---|---|---|
| 2228 | Bagda | 482 | Teak |
| 2084 | Bandabala | 389 | *Garuga pinnata* |
| 1947 | Kherbaba | 404 | *Teak* |
| 2227 | Jhirpa | 515 | *Garuga pinnata* |
| 2154 | Lokhad Ghogra | 430 | *Garuga pinnata* |
| 1949 | Vikrampur | 451 | *Terminalia tomentosa* |
| 2085 | Jhandababa | 455 | *Teak* |
| 2083 | 250 Turning | 404 | *Albizzzia lebbeck* |
| 2083 | Barajoshi | 396 | *Garuga pinnata* |
| 2083 | Kuanala | 396 | *Teak* |
| 2014 | Bhagpura | 434 | *Garuga pinnata* |
| 2232 | Kaudi | 451 | *Mallotus philippensis* |
| 2229 | Bugibaba | 468 | *Garuga pinnata* |
| 2232 | Jhinjari | 455 | *Teak* |
| 2086 | Mehlu | 448 | *Garuga pinnata* |
| 2229 | Lodiyababa | 468 | *Terminalia tomentosa* |
| 2299 | Theklech Pati | 425 | *Terminalia arjuna* |

**Table7.2. Mean Vegetation Parameters ($\underline{x}$) at the Forest Owlet Nest Sites (N=75)**

| Attributes | Mean (±SE) |
|---|---|
| Percent Teak Density | 47.2 |
| Mean Tree GBH (cm) | 59.79 ± 3.76 |
| Mean Tree Height (m) | 8.89 ± 0.34 |
| Percent Shrub Density | 11.41 ± 1.07 |
| Percent Canopy Cover | 59.66 ± 8.88 |
| Percent Ground Vegetation | 64.69 ± 3.02 |

**Fig. 7.1 Location of Forest Owlet Nests in the Study Area (2013-15)**

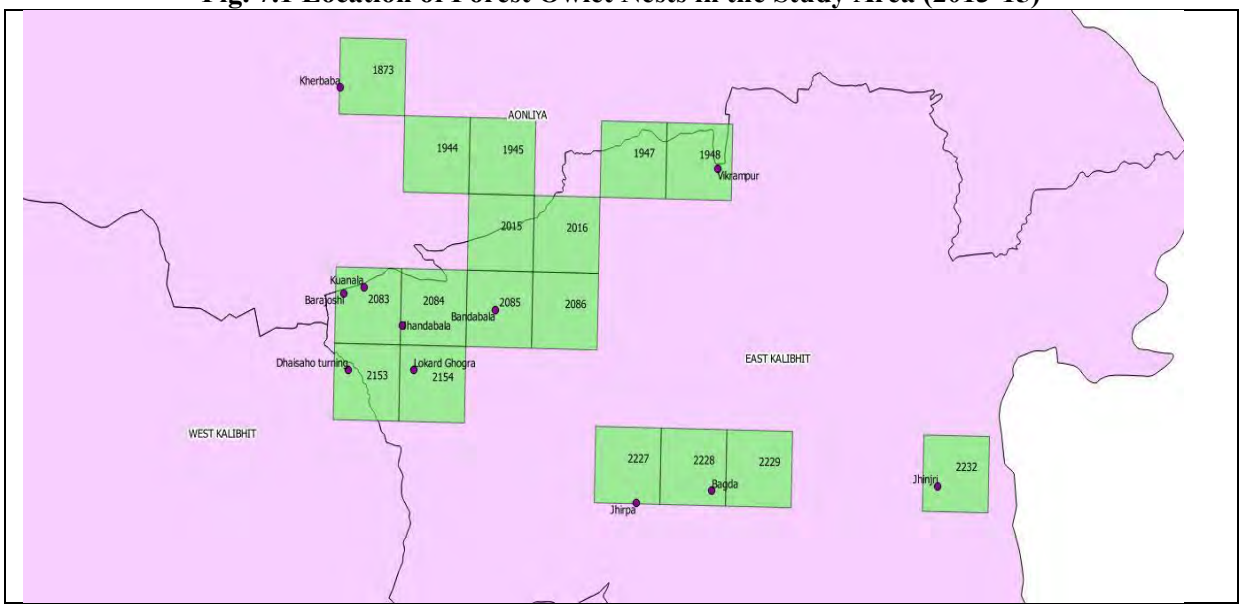
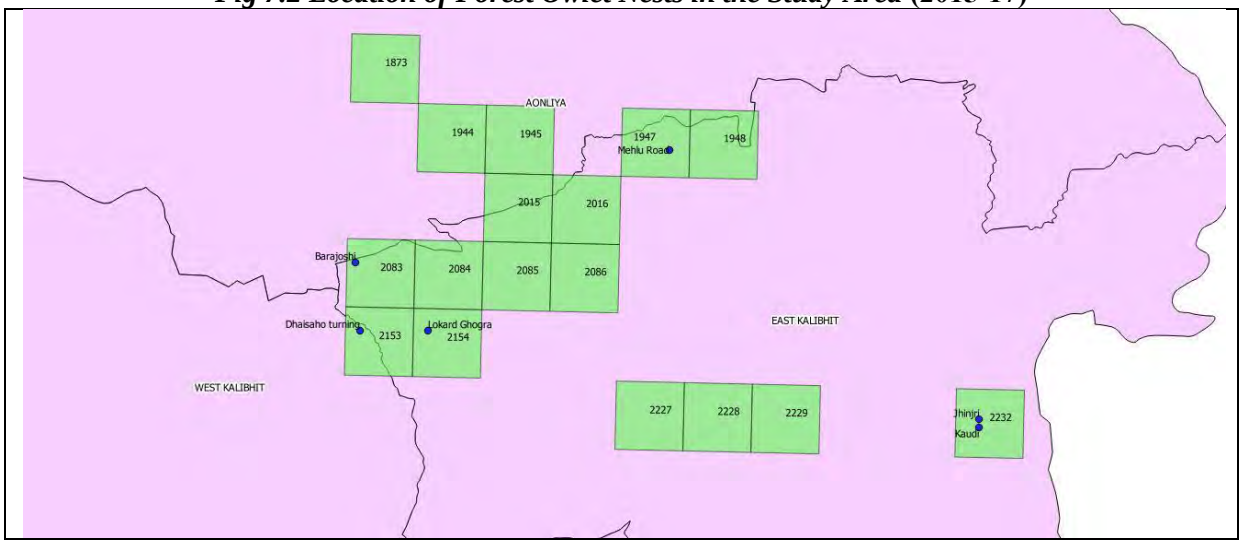



***Fig 7.2 Location of Forest Owlet Nests in the Study Area* (2015-17)**



## 7. 4 Nest Tree Characterization

**Forest Owlet emerging from its nest**

*Prachi Mehta/WRCS*

**Forest Owlet Peeping from the Nest**

*Prachi Mehta/WRCS*

## 7.5 Results

To understand the nest tree selection, we assessed the following parameters:

- Nest tree GBH/DBH
- Nest tree height
- Height of the cavity
- GBH/DBH at the cavity
- Height of the cavity entrance/opening
- Width of the cavity entrance/opening
- Internal width of the cavity (from cavity opening to back wall)
- Internal depth of the cavity (top to bottom)
- Orientation of the cavity in degree
- Distance of the cavity from a road
- Distance of the cavity from an agricultural field
- Distance of the cavity from habitation

**Table 7.3 Forest Owlet Nest Parameters in the Study Area (N=15)**

| Attributes | Mean (±SE) |
|---|---|
| Mean Nest Tree Height (m) | 15.62(±1.53) |
| Mean Nest Tree GBH (cm) | 137.9(±9.8) |
| Mean Height of the Cavity (m) | 7.37(±1.18) |
| Mean GBH at Cavity Height(cm) | 92.4(±5.23) |
| Mean Cavity Entrance Height (cm) | 9 (±1.58) |
| Mean Cavity Entrance Width (cm) | 8.2 (±0.73) |
| Mean Cavity Depth (cm) | 20.75(±1.2) |

**Table 7.4 Tree Species Selected for Nesting by the Forest Owlet**

| Tree Species | Percent (N=17) |
|---|---|
| *Garuga pinnata* | 41 |
| *Tectona grandis* | 29 |
| *Terminalia tomentosa* | 17 |
| *Albizia lebbeck* | 5 |
| *Mallotus philippensis* | 5 |
| *Terminalia arjuna* | 3 |

In the 2013-2014, a total of 13 Forest Owlet nests were located. This was the highest number of Forest Owlet nests located in a season. Copulation was seen on three occasions during the season. This was in the 2083 (Kuanala grid and Barajoshi grid) and in 2084 (Peerbaba) location. Egg laying was seen in the Vikrampura location. Fledglings were seen outside the nest in the Barajoshi nest as well as the Peerbaba nest.

**Table 7.5 Nesting Status of Forest Owlet in 2013-14**

| SL No | Grid Name | Survey Unit | Survey Station | Nesting Tree | Alt (M) | Remark |
|---|---|---|---|---|---|---|
| 1 | Bagda | 2228 | 35414 | Teak | 482 | Saw fallen egg outside the nest |
| 2 | Bandabala | 2085 | 32908 | *Garuga pinnata* | 389 | 3 juveniles hatched. 1 was banded. 1 was found dead outside the nest. |
| 3 | Barajoshi | 2083 | 32621 | *Garuga pinnata* | 396 | I juvenile fledged |
| 4 | 250 turning | 2153 | 33729 | *Albizzia lebbeck* | 404 | No information |
| 5 | Jhandabala | 2084 | 32902 | Teak | 455 | No information |
| 6 | Jhirpa | 2228 | 35409 | Bridelia retusa | 515 | No information |
| 7 | Jhinjri | 2232 | 34873 | Teak | 462 | No information |
| 8 | Kherbaba | 1873 | | *Garuga pinnata* | 404 | Broken egg seen outside |
| 9 | Kuanala | 2083 | 32345 | Teak | 396 | Female was seen incubating. Fledgling not seen |
| 10 | Lokard Ghogra | 2154 | 33733 | *Garuga pinnata* | 430 | 1 fledgling and 1 egg was seen. Both disappeared. Predation? |
| 11 | Vikrampur | 1948 | 30428 | *Terminalia alata* | 451 | |
| 12 | Peerbaba | 2084 | | Teak | | Fledgling was seen and banded |

During the 2014-2015 season, there were 6 active Forest Owlet nests. Out of these six nests there were three that were reused by a pair from the previous year. These were the Barajoshi nest, Lokhad Ghogra nest and the Dhaiso Turning nest. In the previous season, it was only the Barajoshi nest that had successful fledging of young out of the three. During this season, we had seen egg laying although the eggs went missing as the breeding season progressed. In the Dhaiso Turning nest we saw the nest being frequented by the female although there was no information on the egg laying as the tree could not be climbed. No juveniles fledged from this nest either. A new nest found during this season in the 2232-Jhinjri grid in the Kaudi location (35151) was the most successful nest during the

season. From this nest two Juveniles fledged. Out of these two juveniles only one survived. Another new nest of the year was in the jhinjri location (34873). Here also egg laying was seen and hatchlings were seen in December. Although they went missing from the nest Shortly after. This could be due to possible natural predation. The nest in 1947-Bugibaba was another new nest. Here egg laying was seen in the month of November. During the course of incubation, the female died inside the nest. This happened in the month of January. The cause of death was not identified.

**Table 7.6. Nesting Status of Forest Owlet in 2014-15.**

| SL No | Grid Name | Survey Unit | Survey Station | Nesting Tree | Alt(M) | Nest Status | Probable Cause |
|---|---|---|---|---|---|---|---|
| **1** | Barajoshi | 2083 | 32621 | *G. pinnata* | 396 | Eggs went missing | Natural Predation |
| **2** | 250 Turning | 2153 | 33729 | *A ,lebbeck* | 404 | No information about eggs. No Juveniles fledged | Nest was too high to be checked |
| **3** | Jhinjri | 2232 | 34873 | *Teak* | 455 | No Juveniles fledged | Nest was abandoned |
| **4** | Kaudi | 2232 | 34873 | *Soymida febrifuga* | 472 | 2 juveniles fledged, 1 juvenile survived | |
| **5** | Mehlu Road | 2086 | 32357 | *G. pinnata* | 448 | Female died inside nest | Disease? |
| **6** | Lokard Ghogra | 2154 | 33733 | *G.pinnata* | 430 | No egg laying, but cashing of prey was observed. | |

The 2015-2016 season saw a decline in the number of nests. We had three active nests during the season. Out of which one was a new nest in the 2229-Loodiyababa grid in the Loodiyababa location (35150). Here we had egg laying and a single juvenile fledged from the nest in January. There was an influx of birds in the month of March. During this influx 3 new juveniles were seen. They were all located in adjacent sub-grids in the Loodiyababa grid. On the whole there were 4 juveniles within the Loodiyababa grid. The Kaudi nest was also active this year. Here we had two hatchlings inside the nest. During the end of December one of the hatchlings were seen dead inside the nest after which the other hatchling had fledged. The third nest of the season was in 2227-Jhirpa. Egg laying was seen in the month of November. The female had laid only one egg after which the male had gone missing. The female continued to incubate the single egg till the month of December after which she abandoned the nest and was not seen in the location.

**Table 7.7 Nesting Status in 2015-16**

| Sr No | Grid Name | Survey Unit | Survey Station | Nesting Tree | Alt(M) | Nest Status | Probable Cause |
|---|---|---|---|---|---|---|---|
| **1** | Kaudi | 2232 | 34873 | *M.philippinesis* | 472 | 1 juvenile fledged | |
| **2** | Loodiyababa | 2229 | 35140 | *T.alata* | 468 | 1 juvenile fledged | |
| **3** | Jhirpa | 2228 | 35409 | *B.retusa* | 515 | 1 egg laid, nest abandoned | Male abandoned the site during egg laying |

During the 2016-2017 season, four active nests were monitored. This was an increase in nest sites from the previous year. The nest in the Barajoshi location was active again after a gap of one year. There was an un-banded pair occupying the location and the nest became active on the 11$^{th}$ of November. There were four eggs laid in this nest and the female was carrying out incubation. During incubation, the male abandoned the nest location on the 10$^{th}$ of December. The female continued to incubate the eggs till the 14$^{th}$ of December. She then abandoned the nest and was not seen in the location as well. On the 22$^{nd}$ of December on approaching the nest site a broken egg shell was seen at the base of the nest. It had been thrown out of the nest and was on the ground at the base of the tree.

Through camera trap footage of the previous day we had seen a squirrel and a rose ringed parakeet visiting the nest. Either one of these two could be the culprit of the fallen egg. The female was not seen in the location through the rest of the season. The second nest of the season was in Loodiyababa, although this was not the same nest that was used during the previous year. This nest was located just by the State Highway.

An un-banded pair was occupying the location. The female laid 6 eggs in this nest. In the entire span of the study we have never seen such a large clutch size of the Forest Owlet. Hatchlings were seen on the 3$^{rd}$ of December. 3 eggs had hatched and three remained un-hatched. On the 7$^{th}$ of December three rodents were seen inside the nest along with the hatchlings. When the nest was checked on the 13$^{th}$ of December, the nest was found to be empty. The nest was checked last on the 11$^{th}$, within the span of a day the nest had been cleared. Three hatchlings and three un-hatched eggs were missing from the nest. The female continued to occupy the nest location till March.

The third nest of the season was in the kaudi location. The location was occupied by the same pair for three years consecutively. Interestingly this year the pair did not nest in the same nest as the previous two seasons. They selected a new nest 100m away from the old nest. The female laid a single egg in this new nest on the 26$^{th}$ of November. She was seen incubating this egg till the 8$^{th}$ of December. On the 13$^{th}$ the egg went missing from the nest. After which the female stopped using the nest. From all of these nests eggs and hatchlings went missing. This had been seen in previous years as well. It was the second time eggs went missing from the Barajoshi location. the case of these missing eggs could be due to predation from other birds or cavity dwelling mammals. Although we don't have any direct

proof as to how and why these eggs went missing but the most plausible explanation is predation. The fourth and final nest was in a new location. Theklech Patti-2299 was found on 23rd December. By this time the juveniles were already out of the nest. the location had two juveniles with an un-banded pair. One of the juveniles was predated on by an Eagle Owl on 1st February. The other juvenile was seen in the location till April.

**Table 7.8 Nesting Status in 2016 -17**

| Place | Survey Unit | Nesting Tree | Alt(m) | Nest Status | Probable Cause |
|---|---|---|---|---|---|
| Barajoshi | 2083 | *G.pinnata* | 396 | 4 eggs laid, eggs went missing from the nest | Predation |
| Loodiyabab Road | 2229 | *Teak* | 467 | 6 eggs laid, 3 hatchlings and 3 eggs went missing from the nest | Predation |
| Kaudi | 2232 | *Teak* | 469 | 1 egg laid, egg went missing from the nest. | Predation |
| Theklech Patti | 2299 | *T.arjuna* | 431 | 2 Juveniles fledged from the nest | |

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**Camera-trap image of Barajoshi Female entering its nest cavity at 1.30 am**

# Chapter Eight
# Insights in Forest Owlet Ecology using Radio Telemetry

## 8.1 Introduction

Radio telemetry is a valuable tool in understanding the ecology, home-range and movement of a species. Bird movement can b studied using three well established technique, namely using Very High Frequency (VHF) transmitters, GPS transmitters, and Platform Terminal Transmitter(PTT)that uses satellite tracking.

The Forest Owlet is surviving in isolated population in the country and therefore information on its ecological covariate will be useful in understanding its population dynamics. We obtained the permission for Radio-tracking three Forest Owlets from the Ministry of Environment and Forests and Climate Change (MoEFCC, New Delhi) and from the office of the Chief Wildlife Warden of Madhya Pradesh. The radio-tracking equipment including the radio-tags, antennae, receiver and Teflon tapes were donated by the Peregrine Fund, USA .

## 8.2 Methodology

### Selection of Birds

The radio-telemetry was carried out during December 2016 to April 2017. The breeding season of the Forest Owlet starts from October onwards. During the Initial stages of the breeding season pairs of Forest Owlets were identified and monitored to observe if they were breeding. Once pairs were identified individuals were selected for radio tagging. This season saw a low number of breeding pairs with only one pair successfully fledging juveniles. We decided to tag one non-breeding female, one non-breeding male and one breeding male. From our previous observations, we had seen that males tend to move more during the breeding season as compared to females. Hence, we selected two males and one female so that we could compare the movement and home range between the sexes as well as understand the difference between movement patterns of breeding and non-breeding Forest Owlets.

We selected three birds for radio-telemetry.

- Kaudi Female (KUF1): KUF1 was banded in 2015 and was regularly using the sae habitat for last two years. She had a failed breeding attempt earlier in November 2016 where she had abandoned her nest with one egg. Since she did not show further signs of nesting this year, we selected her for this study.
- Kekda Male (KUM1) : This male was banded in 2015. The pair was always at the nest location but did not show any sign of nesting.
- Thekelechpati Male (TPM1): This male had a successful breeding attempt out of which two juveniles had emerged. We selected this male as it was moving around to forage and bring the prey for the female and the 2 juveniles.

### Mounting the transmitter

The radio transmitters were made by Merlin systems. The weight of each transmitter is approximately 4 g which is about 3% of the body weight of the Forest Owlet (160 g-180 g). As per the guidelines for radio-telemetry, the transmitters should be less than 5% of the body weight of the bird. The transmitters we used fall well within that limit. The VHF transmitters mounted on the bird's posterior surface. VHF transmitters emit a highly specific frequency which can be picked up through a receiver

and antenna from approximately 800m. This is a sufficient range as the assumed home range of the Forest Owlet was 500m.

To make mounting of the transmitters easier and more efficient, pre-harnesses were prepared prior to the capture of the birds. This was done by consulting owl expert Mr. David Johnson, Director, Global Owl Project, who guided us through this process meticulously. The pre-harness provide to be very useful as it ensured that the tagging process was quick and the bird handling time was minimized. The pre-harness was made using Teflon ribbons. Teflon being a highly durable material is perfectly suited for making harnesses to be mounted for a long period of time.

All three birds were tagged in the month of December 2016. Once the bird was captured it was weighed. Post weighing the bird the radio transmitter was mounted on the posterior surface of the bird between the wings. Two straps of the harness were passed below the two wings of the bird and an additional two straps were passed around the neck of the bird. They were tightened to ensure that the transmitter could not be dislodged from the bird, and finally crimped just below the sternum of the bird on the anterior surface. This type of backpack harness is a recommended technique in radio tagging of birds. It ensures that the mobility of the bird is not disturbed as well as prevents the harness from being dislodged from the bird during preening or any other behaviour. Once the transmitter was secured on the bird the signal was checked using the receiver to make sure there was not distortion in the signal. Then the bird was weighed once again and released. The same protocol was followed for the other two males. The two males that were selected were the Kekada male (non-breeding) and the Theklech male (breeding), they were tagged on the 24$^{th}$ and 28$^{th}$ of December respectively.

**Putting Radio-tag on the Kaudi Female**

*WRCS*

## Tracking of Tagged Birds

Using this technique, we followed all three Forest Owlets throughout the breeding season. The telemetry data gave us specific perch, roost, foraging and hunting locations of these three birds. Also through the radio telemetry data we understood the habitat use pattern in relation to the behaviour of the bird and the relationship between habitat, perch tree, behaviour and time of day.

Tracking of radio tagged birds can be done through two techniques, i.e. triangulation and direct monitoring. We employed direct monitoring as it proved to give more significant data. The three tagged birds were monitored once every week for a period of 10 hours per day. Monitoring would start at 7 AM and end at 6 PM.

**KUF1 with the transmitter**

*Prachi Mehta/WRCS*

**Tracking the Forest Owlet and recording the habitat data in the field**

*Prachi Mehta/WRCS*

## 8.3 RESULTS

### KUF1

The female from the Kaudi location was the first bird to be radio tagged. Post tagging the female was tracked and monitored on a weekly basis.

- The daily average movement of the female was 143m.
- The longest distance moved in a day being 287m.
- The female was using a territory of approximately 600m$^2$.

We observed that the bird repeatedly used the same perch trees multiple times over the season. She would use the same trees for different activities based on the time of the day. We could not find any

season variation in the perches she preferred. She used the entire home territory throughout the season. The kaudi location is one with a lot of farm land and sparse tree cover. The female moved around this terrain using perches inside the farm as well as perches in the wooded areas. certain activities like Foraging and Hunting were seen only within the farm land.

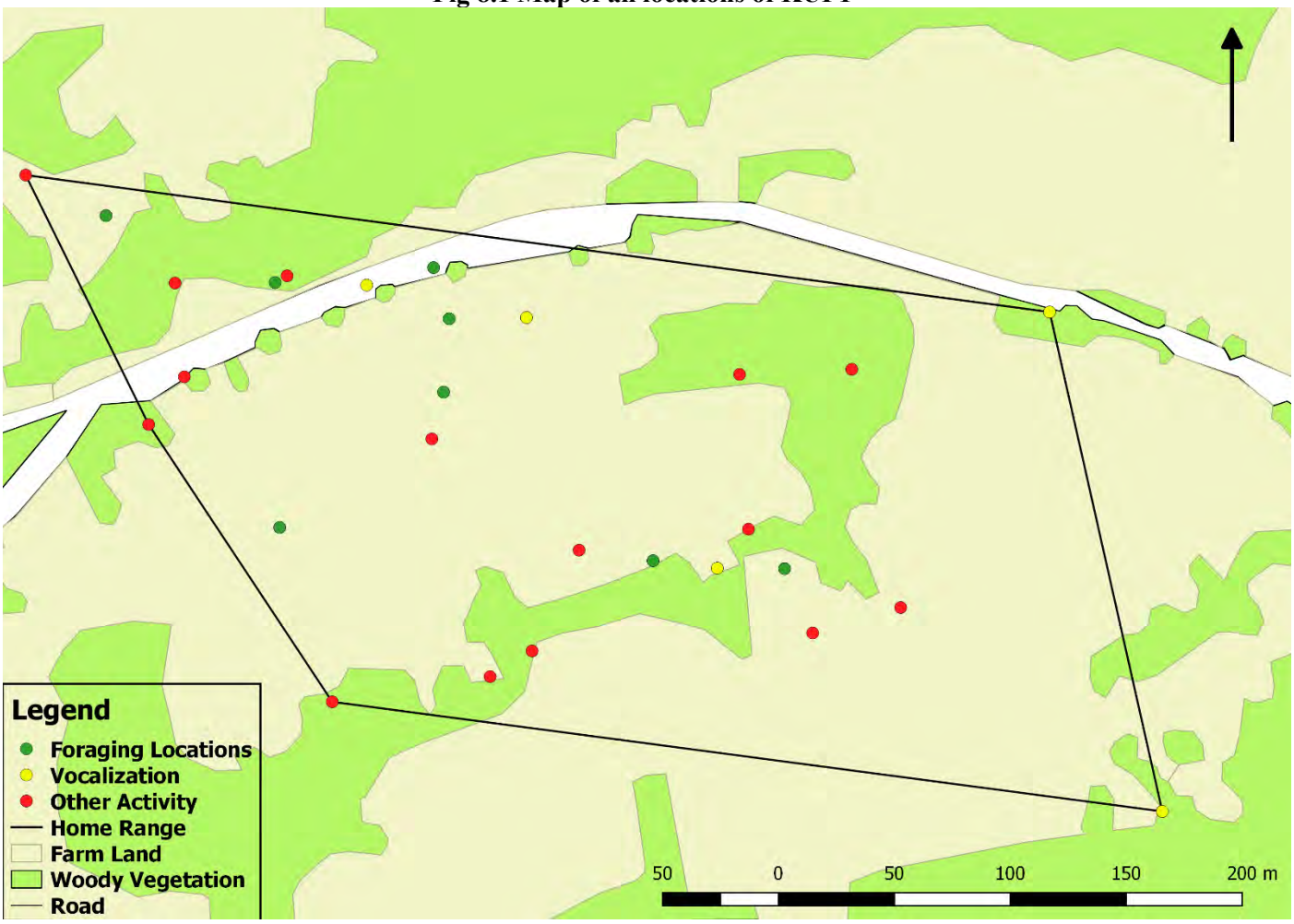
## Monitoring the Behaviour of KUF1

We recorded the behaviour of KUF1 using the focal sampling technique. In this method, the individual was initially tracked using radio telemetry. Upon locating the bird, we observed her from 0600 hrs till 1800 hrs, i.e for the duration of 12 hours once a week. During this time, we made observations every 30 minutes. In a day, every half an hour, we recorded location, perch tree species, tree height and perch height. This gave us a uniform sample set with regular intervals between observations. For the analysis, we correlated time with bird activity (table 1) as well as time with perch tree species, tree height and perch height (table 2). This gave us an insight into the birds behaviour at different times of the day as well as an understanding into the tree species preferred for carrying out an activity.

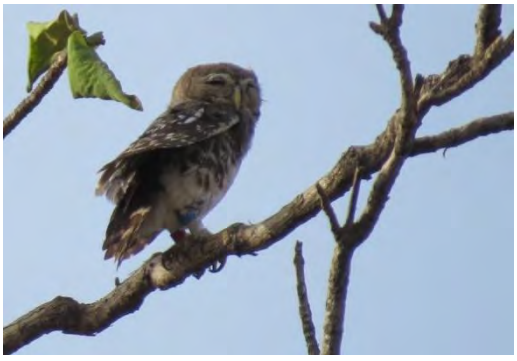
**Habitat of KUF1 (Grid 2232)**

*Prachi Mehta/WRCS*

**Fig 8.1 Map of all locations of KUF1**

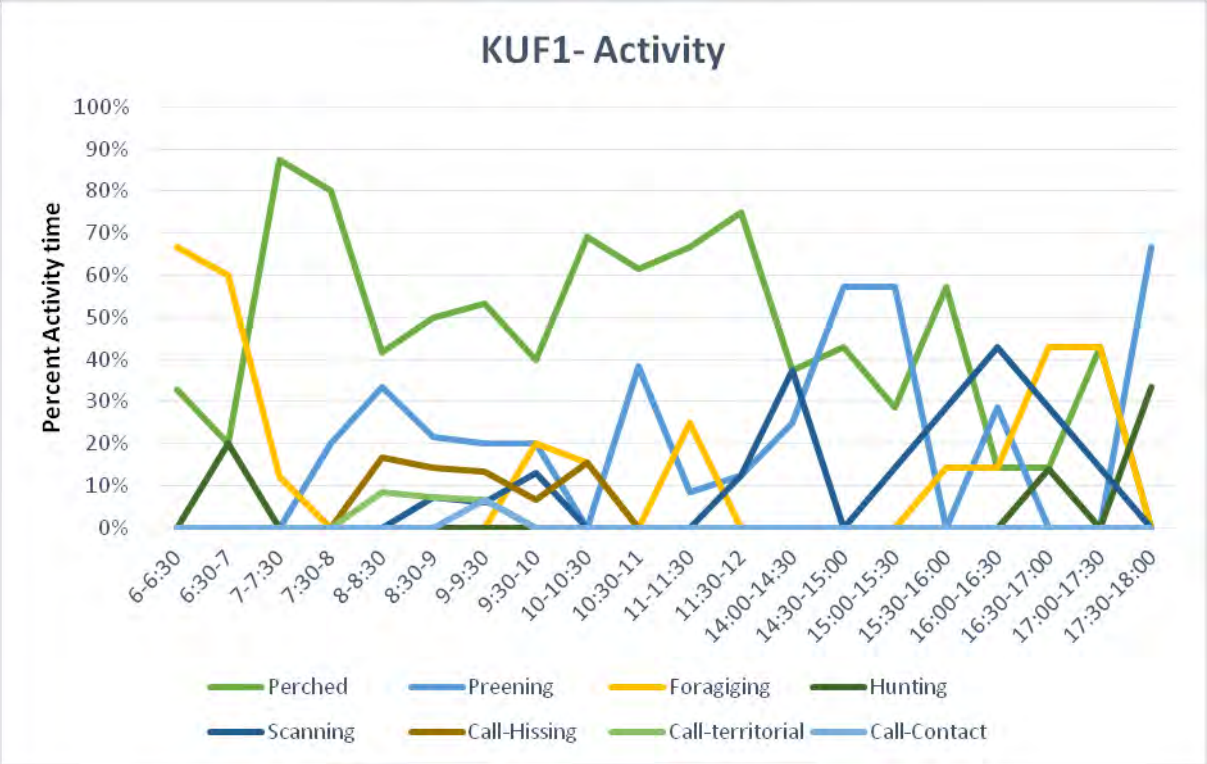



**Forest Owlet Scanning the Ground for the Prey (Left) and Sleeping (Right)**



*Prachi Mehta/WRCS*

Fig.8.2 KUF1 Time- activity Chart




## Habitat Use

The Kaudi location is dominated by farm land and has a sparse covering of vegetation, as can be seen from Figure 1. Hence, we broadly classified the habitat into farm land and woody vegetation. To understand habitat use we compared activity of the female with the habitat in which the activity took place. This gave us a preliminary understanding into the habitat preferences in relation to activity of the female.

Table 8.1 Activity vs. habitat type for KUF1

| Sr. No. | Activity | Farm land | Woody Vegetation |
|---|---|---|---|
| 1 | Perched | 57% | 43% |
| 2 | Preening | 33.40% | 66.60% |
| 3 | Feeding | 100% | |
| 4 | Hunting | 100% | |
| 5 | Scanning | 100% | |
| | Calling | | 100% |

Table 8.1 clearly indicates that the female prefers farm land for hunting and foraging. This could be due the fact that the undergrowth inside the farm land is low in density thereby providing higher visibility of prey. This makes it easier for the bird to spot prey in the undergrowth. All vocalisation of the female took place in areas of woody vegetation. There did not seem to be any such preference in habitat for preening and grooming activities.

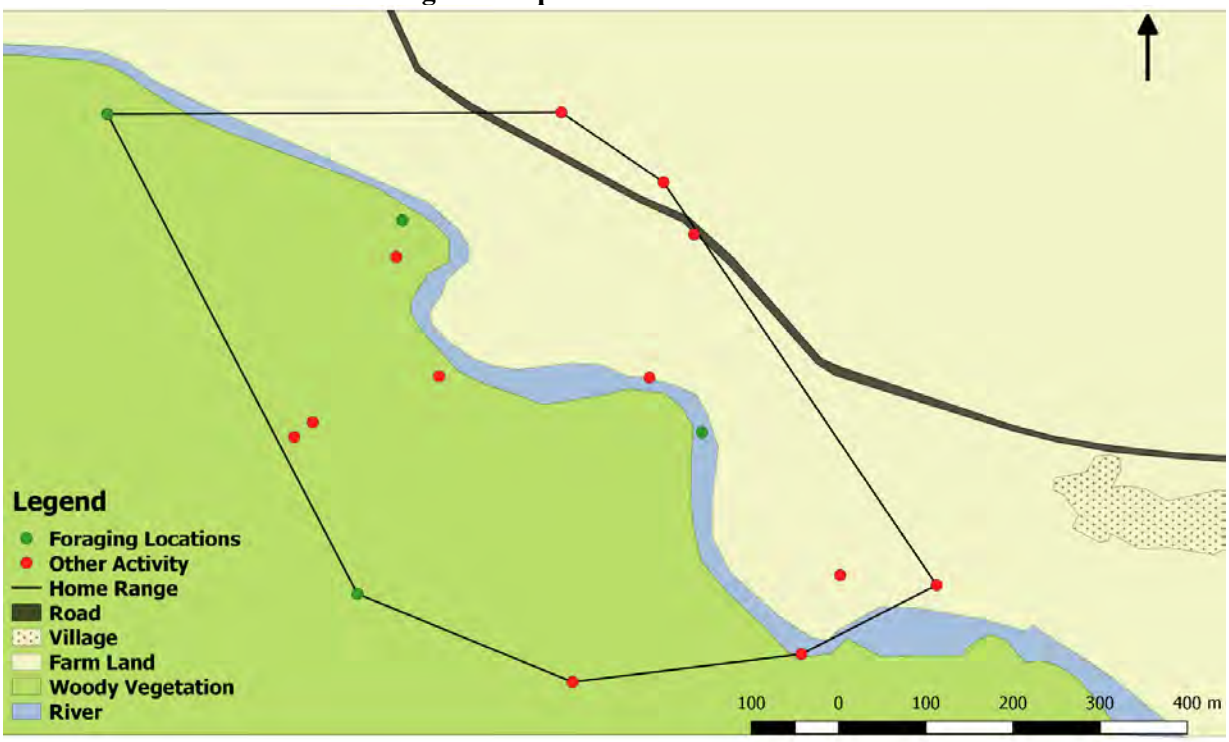
### Theklech Patti Male (TPM1)

The male at Theklech s was a breeding male which was raising 2 juveniles. This male used a larger territory than the Kaudi female. The average movement of the male during a day was 314m, with the longest distance moved in a day being 764m. The area within of his home range was 860m$^2$. This was considerable larger than the female. this could be attributed to the fact that the male was rearing two juveniles and hence the demand for food was much higher. Due to which he had to move to further away foraging and hunting grounds to satisfy the demand of food of the juveniles. The same trend as seen with the female was noticed with this male in which he reused the same trees for different activities. The Theklech side has good forest cover as seen in figure 3. It is separated centrally by a river on the other side of which is farm land. The state highway No. 26 also passes through the site and the male was seen on occasion perched on Teak trees on the side of the road. The figure 3 shows all the locations the male was tracked as well as the habitat of the Theklech site.

**Theklechpati Male (TPM1) with transmitter antenna on the left**

*Prachi Mehta/WRCS*

**Fig. 8.3 Map of Locations of TPM1**




**Theklech Patti Male Habitat**

*Prachi Mehta/WRCS*

## Behaviour

- The same protocol for behavioural observation was followed for the male as was used with the Kaudi female.
- Although the male was raising two juveniles he did not seem to be very active.
- Only one instance of successful hunting was seen in all the days of observation. During this instance the male flew 764m with the rodent and delivered it to the female who then gave it to one of the juveniles.
- Another interesting point to be noted was that the male never once made any type of vocalisation. The two juveniles and the female were very vocal with hissing calls but the male never once performed any type of vocal display. This was very different from the Kaudi female who spontaneously called multiple times.
- The male only foraged in the late evening, with one successful instance of prey capture. This occurred at 16:17 where the male captured a fairly large rodent.
- Majority of the time the male was either perched in one location not exhibiting any behaviour or was preening. Table 4 gives an overlay of the males behaviour.
- A similar trend was seen in the preference of Teak trees as was with the KUF1. The TPM1 showed 89% preference for Teak trees as compared with other species.
- As seen with the Kaudi female whenever the male was foraging or hunting he always used a teak tree as a perch. Table 5 shows the relationship between time of day, tree species, tree height and perch height.

## Predation of TPM1

The Theklech site was also home to two pairs of Eagle owls. Both these pairs were nesting. These two pairs were located less than 200 m from the Forest Owlet nest. Eagle owls are voracious predators especially during rearing of their young. On 1st February 2017, we found a kill of one of the juveniles. The kill site was near the forest owlet nest. We found the feathers strewn on the banks of the river. This appeared to be one of the juvenile which was predated by the Eagle Owl.

On the 9th of April, we found another kill of a Forest Owlet. The scene was the same with feathers strewn on the ground. The point in which this kill varied was that we found a piece of Teflon along with the feathers. The Theklech male had not been spotted in the location since the end of March. Although we were getting a signal from the transmitter the bird was not spotted. On finding this kill we assumed that the Eagle Owl had killed the male. The transmitter was not located.

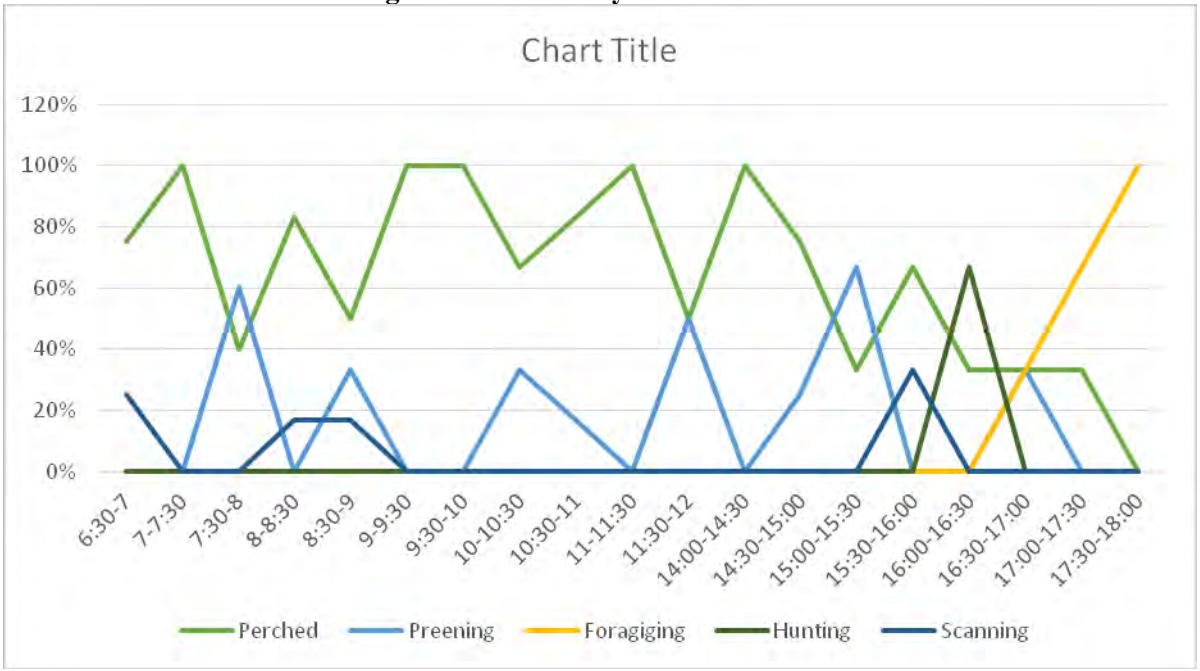
**Predation of Juvenile Forest Owlet at Theklech Patti by Eagle Owl**

*Akshay Anand/WRCS*

**TPM1 Predation by Eagle Owl.**
**Arrow shows remains of teflon tape**

*Akshay Anand/WRCS*

**Fig. 8.4 Time-activity Chart for TPM1**




## Habitat Use

The Theklech site had a good cover of Forest area as is evident from figure 3. Due to the larger area of forest land the male was seen mainly in the forest area as compared to the farm land. Only three perches were used outside of the forest area. The perches in the farm land did show any significant behaviour. Most of the time when the male was using these perches he would be perched with his eyes closed. Unlike the Kaudi female, all foraging and hunting activities were seen in forested area. Most of the observations of the male were in the forested area. This is starkly different from the KUF1. Table 6 shows the relationship between habitat and bird activity.

**Table 8.2. Activity vs. habitat type for TPM1**

| Activity | Farm | Forest Area |
|---|---|---|
| **Perched** | 60% | 40% |
| **Preening** | | 100% |
| **Foragiging** | | 100% |
| **Hunting** | | 100% |
| **Scanning** | | 100% |

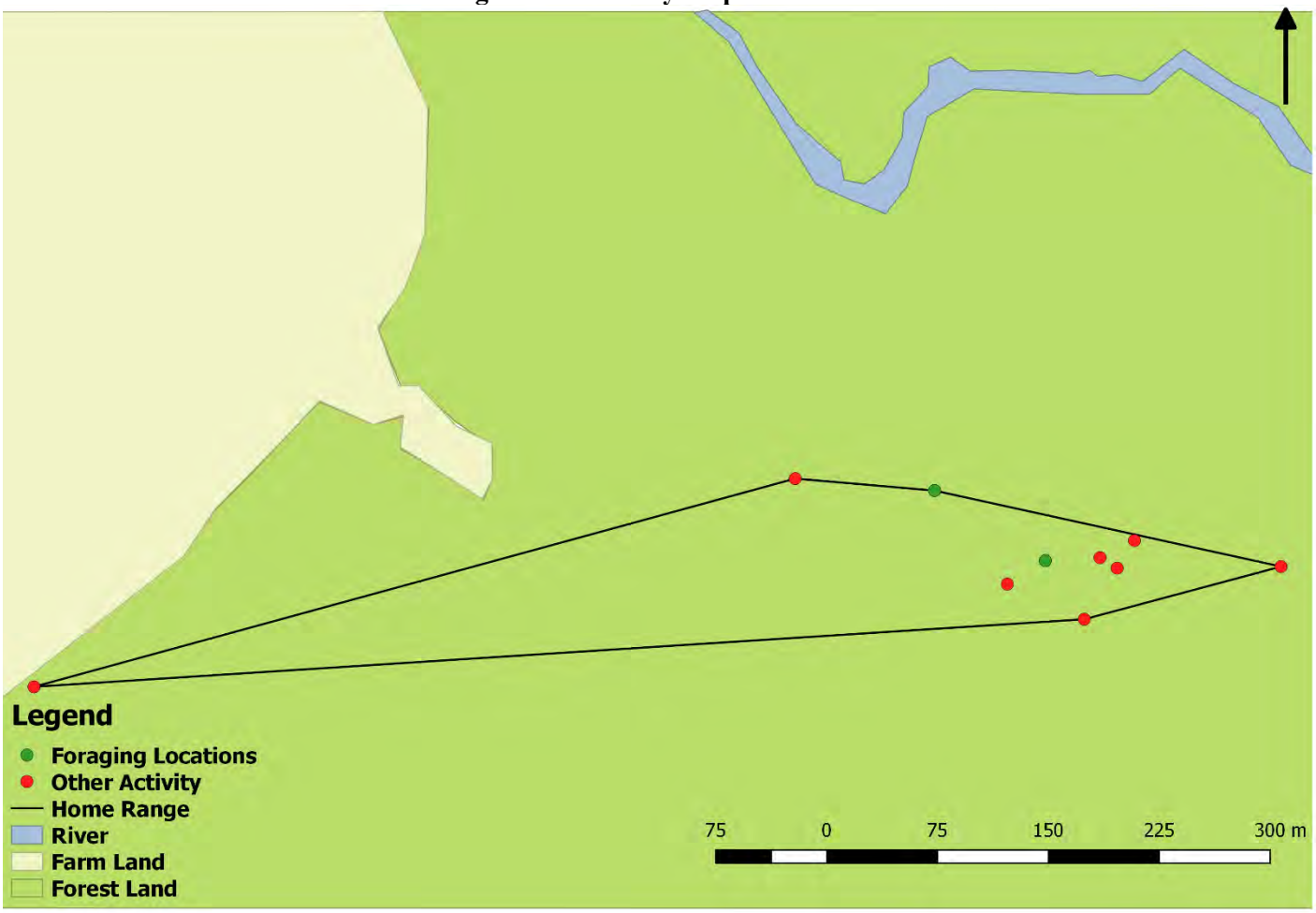
## 250 Turning Male (DTM1)

The 250 Turning male was the second male to be radio-tagged. Unfortunately, the transmitter that was mounted on him had malfunctioned within 2 weeks of capture. Hence, we could not get substantial data on this particular male. Figure 5 shows the map and locations of the male before the transmitter malfunctioned.

**DTM1. Transmitter and antenna visible on the right side.**

***Akshay Anand/WRCS***

**Figure 8.5. Activity Map of DTM1**




## 8.4 Summary of Observations on Radio-Tagged Forest Owlets

- Radio telemetry data has given us a preliminary insight into the home range and movement patterns of KUF1, TPM1 and partly for DTM1.
- The movement pattern appear to be different a breeding male and a non-breeding female.
- TPM1 which was a breeding male had an average daily movement of 314m as compared to 143m from the KUF1 who was not breeding.
- TPM1 had a home range of 860$m^2$ . KUF1 had a home range of 640$m^2$.
- KUF1 foraged and hunted in the crop field.
- TPM1 foraged and hunted only in the forest area. This could be due to the different habitat type at these two sites. The Theklech site has considerably higher forest cover as compared to the Kaudi site.

- The Kaudi site has a sparse covering of trees without any large stretch of undisturbed forest. This could be the reason for the difference in habitat use between these two birds.

- One of the most interesting outcomes of this study was the preference of both birds to Teak trees.
- KUF perched on teak 91% of the time and the TPM1 used teak perches 89%  This shows a very definite preference for Teak perches by both these birds.  As discussed earlier teak trees offer suitable perches for the birds at lower heights thereby making foraging and hunting more possible.

- Our study is limited by the sample size and duration of observation. However, it demonstrated the usefulness and accurate information one can get using radio-telemetry including home range, movement, habitat use and predation pressure. Within a short time span, we were able to gain such insights in to Forest Owlet ecology. We therefore suggest a longer term telemetry study on male, female and juvenile in different seasons and habitat type to develop better understanding of the species.

*Prachi Mehta/WRCS*

# Chapter Nine
# Anthropogenic Pressures on the Forest Owlet habitat

## 9.1 Impact of Selective Logging on the Forest Owlet Habitat

The Reserved Forests of East Kalibhit are managed for harvesting teak trees and other selected tree species by the Madhya Pradesh Forest Department. The timber harvesting is done under Selection Felling system. There are specific prescriptions for the felling rules under which trees are selected and harvested.

Following section briefly describes the prescriptions of timber harvesting under Selection Felling system.

- The compartments are surveyed to assess and enumerate the existing stock of the trees and status of regeneration of trees.
- Following this exercise, the compartment is divided in sections based on the stock density of trees. The section which has over good percent tree density and regeneration of timber tress are ear marked for felling. Steep slopes, river beds, understocked and blank areas are exempted from felling.
- Tree harvesting is done in areas marked as coups. The coups numbered from I to XX as the rotation cycle is for 20 years. Each year, coups marked with same numbers are harvested. Each coup comes for felling after a gap of 20 years.
- Tree marking exercise is carried out during October to February. Tree felling commence from coming October to March.
- Teak and *Terminalia tomentosa* > 120 cm girth are marked for felling
- Other trees between the girth of 60 to 100 cm girth are marked for poles and small timber
- Malformed, dead and dying trees are removed during felling.
- In each coup, specific species of fruit-bearing trees and a few cavity tress are exempted from felling.

In 2013-14, coup number XI and XII were selected for timber harvesting under selection felling in East Kalibhir Range. In 2014-15, no coup was selected for harvesting the working plan was undergoing revision and the timber was obtained from draw down areas of Tawa reservoir in Itarsi district. In 2015-16, in the new working plan, coup no. II was selected for timber harvesting. Accordingly, we chose the same coups for studying the impact of timber harvesting on the Forest Owlet.

**Trees cut under selection felling system by the Forest Department**

*Prachi Mehta /WRCS*

**Table 9.1 Status of Forest Owlet in Timber Harvested Coups in East Kalibhit Range**

| | | Status of Forest Owlet Prior to Felling | Status of Forest Owlet Post Felling | Status of Forest Owlet Post Felling | Status of Forest Owlet Post Felling |
|---|---|---|---|---|---|
| **Coup XI and XII** | Survey Unit | 2013-14 | 2014-15 | 2015-16 | 2016-17 |
| **Khategaon** | 1955 | We did not detect any Forest Owlet | No Forest owlet | No Forest owlet | No Forest owlet |
| **Jhirpa** | 2227 | A pair of Forest Owlet was present | The pair was present but did not nest. | The pair was present for a short while but disappeared later. | Pair nested with 1 egg. Female abandoned the nest. |
| **Bagda** | 2228 | A pair of Forest Owlet was present. I bird was found dead. Natural Predation. | The pair was present but did not nest. | The pair had shifted their location. No sign of nesting. | The pair was present but did not nest. |
| **Loodiyababa** | 2229 | Did not detect any Forest Owlet | Saw a juvenile Forest Owlet. | Detected 1 pair of Forest owlet and their nest. | Detected 2 pairs of Forest. Unsuccessful nesting. |
| **Chattubattu** | 2231 | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet |
| **Chadida** | 2373 | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet |
| **2014-15 area** | **No tree felling in the** | | | | |
| **2015-16** | | | | | |
| **Coup II** | | | | | |
| **Dholgaon** | 2507 | No Forest Owlet | No Forest Owlet | No Forest Owlet | No Forest Owlet |
| **Chadida** | 2373 | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet |
| **Keliphahdi** | 2089 | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet | Did not detect any Forest Owlet |

## 9.2 Impact of Tree Cutting by Local People

The Forest Owlet habitat in East Kalibhit Reserved Forests is under tremendous pressure due to illicit tree cutting. Local villagers cut mature trees in large numbers for their personal requirements. The trees are cut for construction of house, for harvesting Aonla (*Embelica officinalis*), Achar (*Buchnania lanzan*) and tendu (*Diospyros melanoxylon*) fruits. Also, trees are cut for removal of bee-hives and taking out hatchlings of parakeets and other birds. Destruction of cavity trees and removal of hatchlings is the most serious threat to the conservation of Forest Owlet in the area.

During the study, we observed tree cutting by local people in almost all the sites occupied by the Forest Owlet. The table below provides tree species name and the grid number where we observed cutting of large mature trees.

**Table 9.2 Details of tree cutting in Forest Owlet Occupied Areas**

| Sr. No | Grid Name | Location | Tree cutting observed |
|---|---|---|---|
| **1** | 2153 | Kekada | *Teak* |
| **2** | 2014 | Bhagpura | *Teak* |
| **3** | 2083 | Kuanala | *Teak* |
| **4** | 1955 | Vikrampura | *Teak* |
| **5** | 2085 | Mehlu Road | *Amla* |
| **6** | 2085 | Mehlu Road | *Amla* |
| **7** | 2085 | Mehlu Road | *Amla* |
| **8** | 2085 | Mehlu Road | *Amla* |
| **9** | 2014 | Bhagpura | *Teak* |
| **10** | 2014 | Bhagpura | *Teak* |
| **11** | 20185 | Mehlu road | *Teak* |
| **12** | 2232 | Jhinajri | *Terminalia tomentosa* |
| **13** | 2085 | Peerbaba | *Teak* |
| **14** | 2085 | Mehlu Road | *Teak* |
| **15** | 2014 | Bhagpura | *Teak* |
| **16** | 2083 | Govindnala | *Teak* |
| **17** | 2083 | Govindnala | *Teak* |
| **18** | 2083 | Govindnala | *Teak* |
| **19** | 2083 | Govindnala | *Teak* |
| **20** | 2014 | Bhagpura | *Teak* |
| **21** | 2014 | Bhagpura | *Teak* |
| **22** | 2014 | Bhagpura | *Teak* |
| **23** | 2014 | Bhagpura | *Teak* |
| **24** | 2085 | Jamunnala | *Teak* |
| **25** | 2014 | Bhagpura | *Teak* |
| **26** | 2014 | Bhagpura | *Teak* |
| **27** | 2085 | Peerbaba | *Teak* |












*All photos by WRCS*

**Collection of firewood and tree cutting in the area**




*Prachi Mehta/WRCS*

*Prachi Mehta/WRCS*

## 9.3 Impact of Forest Fires on the Forest Owlet Habitat

From February to April, local people go to the forests to collect mahua flowers and tendu leaves. During this time, people set the forests on fire as it helps them to collect yellow colored flowers from black forest floor. However, this has a devastating effect on many trees which catches fire. Mature trees with cavities that are used for nesting get destroyed due to fire. The fires also impact the regeneration and grass cover. This in turn affects the ground dwelling insects, birds and rodents. Insects and rodents are preyed up on by many birds including owls so forest fire impacts the breeding and foraging niche of owls and other birds in the area.

**Fire in the Forest Owlet Habitat**

*Prachi Mehta /WRCS*

*All photos by Prachi Mehta/WRCS*

## 9.4 Impact of Speeding Vehicles on Wildlife in the Study Area

The state-highway (SH 26) from Khandwa to Betul passes through Khandwa division. There is considerable thoroughfare through this road by trucks, state buses, jeeps, private cars and two-wheelers. The road is in good condition so the vehicles operate at a high speed. On the either side of the highway, there are villages, crop fields and Reserved Forests of East Kalibhit Range. Local people including children use the highway for crossing over to the other side. Since the highway passes through the forests, many birds, mammals, and reptiles use the sides of the roads for breeding, hunting, resting or moving between areas.

The vehicles operate at a high speed during the day as well as night on SH 26. Since the start of our work in 2013, we have observed one human death and many wildlife road kills on the highway. A date-wise list of the species killed, their location of the incident and photographs is enclosed with this note for your information.

The forests in the area support good wildlife including the critically endangered forest owlet. Among the other species killed in the area, one forest owlet also died in the road accident. Owls often sit by the side of the road at night or early morning for hunting insects and rodents. The speeding vehicles can't see them so they get run over an eventually die.

**Table 9.3 List of road-kills on SH 26 (2014-15)**

| Sr No. | Date | Species | Location name |
|---|---|---|---|
| **1** | 27/5/14 | Forest owlet | Barajoshi |
| **2** | 8/1/15 | Greater Coucal | Near Jhinjri |
| **3** | 26/4/15 | Greater Coucal | Near Patajan |
| **4** | 25/5/15 | Great Tit | Near Bagda |
| **5** | 2/3/15 | Great Tit | Near Mehlu |
| **6** | 29/5/15 | Indian Roller | Bandababa |
| **7** | 8/4/15 | Indian Roller | Barajoshi |
| **8** | 20/5/15 | Indian Roller | Langoti |
| **9** | 7/5/15 | Scops owl | Mundaghat |
| **10** | 10/2/15 | Jungle owlet | Mundaghat |
| **11** | 19/3/15 | Spotted Owlet | Awaliya |
| **12** | 12.06.2015 | Spotted Owlet | Bagpura |
| **13** | 12/12/14 | Indian Civet | Bagda |
| **14** | 3/6/15 | Pipet | Bagda |
| **15** | 8/5/15 | Snake | Chattubattu |
| **16** | 2014 | Barn owl | Bhagpura |
| **17** | 2014 | Spotted Owlet | |
| **18** | 19/10/15 | Bronze Back Tree Snake | Near Bagda |
| **19** | 23/20/25 | Nightjar | Awalia |
| **20** | 27-10-15 | Nightjar | |
| **21** | 27-10-15 | Jackal | Langoti |
| **22** | 27-10-15 | Nightjar- 2 | Awalia |
| **23** | 28-10-15 | Nightjar | Bhagpura |
| **24** | 28-10-15 | Nightjar | Bhagpura |
| **25** | 29-10-15 | Nightjar | Jhinjri |
| **26** | 02-11-15 | Nightjar | Awalia |
| **27** | 02-11-15 | Nightjar | Ashapur |
| **28** | 04-11-15 | Rat Snake | Mehlu |
| **29** | 06-11-15 | Babded Krait | Fokatpura |
| **30** | 06-11-15 | Greater Coucal | Chattu Battu |
| **31** | 17-11-15 | Rabbit | Mundaghat |
| **32** | 19-11-15 | Jungle Cat | Ashapur Nursery |
| **33** | 19-11-15 | Langur | Jamni |
| **34** | 20-11-15 | Civet | Mundaghat |

**Forest Owlet road kill May 2014**

*WRCS*

Jungle owlet roadkill

Indian Roller roadkill

Scops Owls roadkill

Great Tit roadkill

Pipit Roadkill

Snake roadkill

Jungle Cat Roadkill

Hanuman Langur Roadkill

Civet Cat Roadkill

Hare Roadkill

*All photos by Akshay Anand /WRCS*

## 9. 5 Artificial Nest Predation

We observed a few instances of nest predation by local people. Local people remove hatchling and eggs of parakeet. We also observed tempering of nests of Spotted Owlets as well.

**Nest tree and nest of parakeet slashed for removing hatchlings**

The same tree had nest of Forest Owlet in the cavity

*Prachi Mehta/WRCS*

## 9. 6 Owl Trade in the Study Area

It is difficult to obtain information on owl trade as local people do not easily reveal the information. However, we have information on local tribals from neighbouring villages coming to East Kalibhit forests to capture Eagle Owl and Brown Fish owl. They may be also hunting small owls for trade and for the pot.

*Prachi Mehta/WRCS*

# Chapter Ten
# Conservation Initiatives for the Forest Owlet in the Study Area

## 10. 1 Introduction

The ecology and survival of a species is closely related its habitat and the types of pressures faced by the species.
We studied the ecology of Forest Owlet in East Kalibhit Range from 2013 to 2017. The ecology and survival of the Forest Owlet is linked to the anthropogenic factors on the habitat.

We outline the relationship between survival of the species and other extraneous factors below:

- The Forest Owlet occupies teak-dominant forests in the study area.
- The habitat of the Forest Owlet is surrounded by villages and their crop fields.
- In the study area, the breeding success of Forest Owlet is low.
- The habitat of the Forest Owlet faces several types of pressures due to people's presence.
- State Highway 26 passes through the Forest Owlet habitat in the study area. Speeding vehicles plying on the highway causes many road kills including owls, other birds, reptiles and small mammals.
- The survival and breeding success of Forest Owlet is impacted due to removal of its cavity–trees.
- Cavity-trees are removed during timber harvesting and /or due to tree cutting by local people.
- The local people are dependent on the forests for their daily needs of firewood. They also use the forests for collecting mahua flowers and timber, part of which they keep for self-consumption and remaining they sell for commercial purpose.
- The field staff in territorial forests is trained mainly for timber production. They do not have required information on biodiversity in their area and management of wildlife in their forests.
- Local villagers use the forests with considerable negligence. The signs of anthropogenic pressures in terms of cutting of large, mature trees, expansion of agricultural areas by encroaching on forest land, setting fires in the forests and removing eggs and hatchlings of birds from their nests is seen in all Forest Owlet occupied sites.

To address these issues, we identified vital stakeholders and implemented following conservation actions in the study area

a. Working with the Forest Department : Forest Officers and the frontline staff are the most important stakeholders in owl conservation. It is important to share the findings of the study with the Forest Department as it will help in sensitizing and generating awareness about owl conservation among senior officers and frontline staff. Timber harvesting and felling rules are prescribed by working plan officers. If they are made aware of the ecological needs of the owl, they can make necessary amendments in the felling rules. Also, if the field staff is oriented and informed about owls in their area, they will be motivated to monitor owls in their area.
b. Conservation Partnership with Local Farmers: Owls share their habitat with local communities and farmers. The nest trees of owls are usually located in and around the crop fields. Farmers need to be involved in protection of owls in their own farms. For this purpose, we initiated a livelihood generating program through which local women are trained in making handicraft items based on owl theme. The idea is to make a connection between owls

and livelihood needs of local people. If owls are perceived as income providers, then there is an incentive to protect them.

c. Generating Public Awareness on Importance of Owls: General public remain the most important supporter of conservation efforts. Owls are often perceived as the harbinger of death or ill omen among lay men. Also, owls are used for trade and black magic among tribal communities. There is a need to eradicate negative connotations about owls from public mind. We addressed this issue by creating awareness about owls and their usefulness around villages, schools and along the state highway.

## 10.2 Working with the Forest Department

### Workshop No 1: KNOW YOUR OWLS

**Date and Location:** January 2014, Range Office, East Kalibhit

**Objective of the Workshop**: The field staff in the territorial forests is trained mainly for forestry operations and forest management. They do not receive much input on importance of conserving biodiversity though many individuals are interested and have good knowledge on wildlife. The objective of the workshop was to inform and orient the field staff of East Kalibhit and Awaliya Range about the diversity of owls in their area and get them familiarized about the owl species inhabiting their area.

**Participants of the Workshop**: Mr. Ramesh Markam, Range Officer, East Kalibhit, foresters and forest guards from the range. Total 15 participants

**Workshop Module**:

Theory Session: Dr. Prachi Mehta conducted the workshop along with field biologist and field assistant. Dr. Mehta conducted a presentation types of owls found in Khandwa division. their appearance, calls and nesting and feeding requirement. There was a discussion on importance of protecting the owls and their habitat and the importance of owls in biodiversity conservation.

Field Session: Post-lunch, there was a field session where all the participants walked in the forests, looking for owls. We were able to show them the roost and nest sites of brown fish owl, mottled wood owl, Spotted Owlet and Forest Owlet. The field staff were shown owl pellets and methods of identifying prey from the pellets.

Publication : We have started a series known as School of Owls through WRCS. Under this, we published a pictorial guide for the field staff Know your Owls or उल्लू की पहचान which gives information about the species of owls , their habitat, their calls and threats faced by them.

# उल्लू हमारे दोस्त श्रृंखला में (School of Owls)
# क्रमांक-१: उल्लूकी पहचान Know Your Owls



***Mehta Prachi and Jayant Kulkarni 2014. Know Your Owls. A field guide for public awareness and owl conservation. School of Owls Series 1. Wildlife Research and Conservation Society, Pune.***

**Theory Session for the field staff**

**Field Session for the Field Staff**

## 10.3 Outcome of workshop 1

- Through this workshop, the field staff was informed about the importance of owls, their functions in the ecosystem and specifically about the ecology of all 8 owl species found in the study area.
- The field staff has agreed to monitor their own beats to record the presence of any owls or their nests and inform us about the same.
- WRCS research team will inform the field staff of the nest sites in their beats so that these trees are not disturbed during forestry operations.
- The problem of encroachment, illegal tree cutting and tree girdling is quite commonly seen in the Reserved Forests. During the workshop, these concerns were shared with the field staff. Although these are illegal activities, it is difficult to completely stop it. It was suggested that we take a joint meeting in the villages and discuss the importance of protecting the forests and sustainable use to the people.
- The local tribals who inhabit this area are *korkus, gonds, rathiyas* and *thatiyas*. It may be more effective to reach out to them by incorporating their social and cultural beliefs to motivate them in protecting the forests.
- The workshop was successful in motivating the field staff to participate in conservation of owls and their habitat and also highlighting the issues of biotic pressures on the forests.

**Participants of the workshop**


## Workshop No 2: Nests of Owls

Date and Location: December 2015, Awaliya Lecture hall

Objective of the Workshop**:** Forest owlet is a cavity-nesting species. It nests in tree cavities that are made by the woodpeckers or barbets. It also uses tree hollows for nesting , roosting or caching its prey. As a part of the study objectives, we have been monitoring the nesting and breeding biology of the forest owlet in East Kalibhit Range.Cavity-bearing trees are very important to protect for ensuring survival of all the cavity-dependent species. The East Kalibhit Reserved Forests are being managed for timber harvesting under selection felling by the Madhya Pradesh Forest Department. This workshop was aimed at discussing the provisions of timber harvesting in East Kalibhit Forests and formulating conservative guidelines for protecting cavity-bearing trees.

Participants of the Workshop**:** Totally 140 persons. Dr. Pankaj Srivastava, CCF Khandwa, Mr. Anndurai CCF Research and Development, and Mr. Praful Phuljade, DCF Production, Khandwa. 125 frontline staff from Khandwa, Burhanpur and Betul Divisions, 10 students from college in Roshni also attended the workshop. From WRCS, Dr. Prachi Mehta, Mr. Akshay Anand, and Mr. Babu participated in the workshop.

Publication: On this occasion, we published a second pictorial guide under School of Owls Series 2, known as House of Owls or "उल्लू का घर" for the field staff. The guide describes breeding and nesting

requirements of owls found in the study area, threat to their nests and how one can help in protecting the nests.

**उल्लू का घर (House of Owls)**

**दिसम्बर २०१५ (December 2015)**

*Mehta Prachi and Jayant Kulkarni 2015. House of Owls. A field guide for public awareness and owl conservation. School of Owls Series 2.Wildlife Research and Conservation Society, Pune.*

Theory Session: Dr. Mehta presented an outline of the forest owlet ecology project and discussed the objectives, methodologies and findings of the on-going work. The presentation included information on owls found in Khandwa, Burhanpur and Betul area, a description of their calls and their breeding requirements in terms of types of nest, incubation period and dispersal of the young. Mr. Akshay Anand discussed the importance of cavity trees and structure of the trees for nesting birds. He also screened the videos taken in the study area of birds using the nest trees and using access branches for entering or exiting from the nest.

**Dr. Prachi Mehta and Mr. Akshay Anand discussing the ecology of Forest Owlet**

Field Session

After the introductory session, all the participants were taken to field to observe the Forest Owlet and spotted owlet. In the field the participants were taught to locate owl nest by looking for signs such as presence of regurgitated pellets and white droppings below the trees. The field visit was important as it helped in understanding the pressures faced by the owls on its habitat in terms of tree cutting, grazing and impact of tree removal on the nesting of the owlets.

**Workshop Participants observing the nest**

**Forest Officers and Field Staff observing Nesting Signs**

**Field Session in progress**

**Dr. Pankaj Srivastava CCF Khandwa addressing the workshop participants**


Dr. Pankaj Srivastava guided the staff about taking conservative actions for tree felling while timber harvesting in their area. He suggested following amendments in the felling rules:

- The tree marking production staff has to locate trees in their area, inform the DCF and that tree will not be felled. For this reason, the protection can be done at state level itself
- While marking, if any nest trees have been marked by mistake, it can be exempted from felling.
- The DCF and field staff should work closely with the WRCS research team on conservation of owls in the Reserved Forests.

**Mr. Annadurai, CF (R & D) addressing the participants**

Mr. Annadurai mentioned the following points:

- Globally there are 17 Critically Endangered Species. The Forest Owlet is one of them. It is matter of our responsibility to protect the species.
- The Forest Owlet is not found in any Protected Area in Madhya Pradesh. So it is or job to offer it protection.
- Research and Conservation of Forest Owlet should be a priority in Reserved Forests.

**Mr. Praful Phuljade DCF (Production) Khandwa discussing the working plan**

Mr. Prafull Phuljade discussed the importance of forest owlet and its endemic status. He urged the staff to monitor its habitat against tree felling and orests fires. Mr. Phuljade read out the provisions of current working plan of Khandwa circle and prescriptions of the trees to be marked for felling and for retaining.

**Workshop in progress**


DANGER

## 10.4 Outcome of Workshop 2

**Table 10.1 Proposed Actions by the Forest Department**

| Issues of Concern | Proposed Actions | Actions to be taken by | Duration |
|---|---|---|---|
| **Protection of Cavity Trees** | Prior to marking cavity trees, the area around the tree and on the tree should be checked for nesting signs.<br><br>If any cavity trees are marked for felling , then the field staff checks for nesting status and should contact the WRCS team for confirmation. | Marking field staff<br><br>CCF Khandwa<br>CF Khandwa,<br>DCF(Production) and<br>Marking field staff. | October to May<br><br>October to May |
| **For Nest tree Protection** | If the tree cavity is being used by the owls then the CCF and DCF should be informed. Further action to be decided by the CCF and DCF.<br><br>All known nest and roost trees will be marked for protection. numbered. | Production field staff and WRCS team<br><br>CCF Territorial, DFO Production and WRCS team<br><br>WRCS team in collaboration with the Range Officer of the area and the beat guards of the location | |
| | The farmers and FPC members of the villages should be involved in protection of the trees. The forest department can provide incentives from VFC fund for this activity. | WRCS team, Range Officers, beat guards and Members of the VFCs. | October to March |
| **For Controlling the use of Rodenticides** | Awareness on use of vermicompost and use of owls to control mice in the farms through educational videos, posters and street plays in the villages and schools. | WRCS team along with beat guards | October to April |

| | | | |
|---|---|---|---|
| **Eradication of superstitious beliefs and traditions of trade in owl body parts** | Awareness programs with the help of street plays and education films in villages and schools. | WRCS team along with beat guards | January onwards |
| **Preventing Road Kills of wildlife in the area** | Installation of speed breakers The locations for speed breakers have been provided by WRCS to CCF and CF Khandwa | Action to be taken by Highway authorities. | December onwards |
| **Public awareness on driving slow in the forest areas on road-kills and** | Road signs and posters to be displayed at main locations | CF Khandwa has printed the posters and they are being put up on the road by WRCS team and Range officers | Ongoing. |

**Participants of the Workshop at Awaliya Rest House**

## 10.5 Protection of Nest and Roost Trees of Owls in the Study Area

As describer earlier, there is considerable tree cutting by local people in the study area. This certainly creates an impact on the survival of the Forest Owlet and other owls in the area. With the permission of CCF Khandwa Circle, we painted about 40 trees with green paint in the nest and roost sites of Forest Owlet, Spotted Owlet, Jungle Owlet, Brown Fish Owl, Indian Scops Owl, Mottled Wood Owls and the Eagle Owl. The green paint on trees would deter the villagers from cutting it as they are aware that our research team and the field staff are monitoring this tree. This experiment was hugely successful as except one, all other green belt trees remain intact in the study area.

**WRCS research team putting green paint on important trees in for owl conservation**




## 10.6 Working with Local Farmers as Conservation Partners

To protect the nest trees of the Forest Owlet as well as other owls, we need the co-operation and support of the local farmers. To make them as our conservation partners, we designed a program for the ladies who can be trained preparing owl-themed handicraft items. We decided to make the products with owl theme which would create a positive image of owls as an income provider. We established Ladies Self-Help Groups (SHG) in Awaliya and Jhinjari villages. There are 3 to 4 women in each group who are being trained in the handicraft work. The products made by them are marketed by WRCS and the proceeds of the sale are directed towards the SHG as an incentive for participating in conservation of owls in their farms. WRCS is marketing the owl products under ***Athena*** brand. Owl handcraft items are quite popular among the buyers.

# Athena Products









## 10.7 Awareness Posters for Owl Conservation:

We have made public awareness posters on owl conservation. The concept of the posters were given by Dr. Prachi Mehta and the posters were designed by Mr, Akshay Anand and Mr. Jayant Kulkarni. The posters were printed by CF Khandwa. The posters are displayed on roads, villages and schools in East Kalibhit, Morgadi and Awaliya ranges.

The posters were on following themes:

- Not to capture owls and stop using them for black magic
- Protecting the nest and roost trees of owls
- Not to use Rodenticides in the farms as owls feed on rodents. Owls are natural pest controllers.
- Drive slowly and give way to wildlife

a. Consider owls as Lakshmi Devi's symbol and not eil




## 10.8 Further Work

Our work on the Ecology of Forest Owlet in East Kalibhit Range in Khandwa district in Madhya Pradesh spanned for four years, from 2013 to 2017. In the first phase of the study, we examined various components of the Forest Owlet ecology to understand its site occupancy, habitat selection, diet, breeding biology, nest site selection, population density, demography and movement patterns within the study area. From our field data and observations, it appears that the Forest Owlet is managing to survive in the Reserved Forests along with other species of owls but its breeding success is low.

In the second phase of this project, we plan to initiate and implement conservation actions based on our preliminary work. We shall be working closely with the Forest Department and the local communities in the area to jointly protect the habitat for the Forest Owlet and other owls in the study area.

# Achievements of the Project

## Submission of Progress Reports and Annual Reports

| Year | Report |
|---|---|
| August 2013 | 1st Progress Report |
| December 2013 | 2nd Progress Report |
| March 2014 | 3rd Progress Report |
| June 2014 | 4th Progress Report |
| May 2015 | 5th Progress Report |
| **September 2015** | **1st Annual Report** |
| March 2016 | 6th Progress Report |
| June 2016 | 7th Progress Report |
| **September 2016** | **2nd Annual Report** |
| January 2017 | 8th Progress Report |
| June 2017 | 9th Progress Report |
| **December 2017** | **Final Technical Report** |

## Scientific Achievements

This was the first study on the ecology of Forest Owlet in Madhya Pradesh.

During our study, we successfully color-banded 50 Forest Owlets through which we studied its demography and movement.

Ours was the first study to put VHF radio tags to study the home range and movement of Forest Owlets . We could radio-tagged three Forest Owlets and monitor their movements.

Our study established a new record of Forest Owlet from Betul district in Madhya Pradesh.

## Scientific Dissemination of Information

Publications

December 2014: We have established a publication series known as School of Owls through which we will publish public awareness articles. Under this series, we published a pictorial guide titled " उल्लू की पहचान " ( Know Your Owls) for the field staff of the study area. The booklet describes ecological importance of owls, Misuse of Owls in Indian culture and information on eight species of owls found in the area.

March 2015: Our findings of First Record of Forest Owlet from Betul District has been published in "Indian Birds", a well known Indian ornithology Journal.

December 2015: Through School of Owls series, we published our second booklet " उल्लू का घर" (House of owls ) for the field staff. This booklet provides information on different nest types of owls, threats faced by owls due to tree cutting and types of conservation measured required .

September 2017 : We have published a technical manual on identification of prey remains from owl pellets. The200 page manual includes details on different category of owl prey including mammal, reptiles, bird, amphibian and invertebrate, with identification keys for each taxa. This is first of its type of manual prepared in India.

December 2017: Our paper on comparative diets of Forest Owlet, Spotted Owlet and Jungle Owlet has been accepted for publication in the Journal of Raptor Research (JRR) which is an esteemed International journal for avian research.

## Presentations and Conferences

Dr. Mehta presented the findings of this study at following conferences

March 2014 : Presented a paper on Forest Owlet at Asian Raptor Research and Conservation Network, Pune

May 2014: Conference of Department of Science and Technology, New Delhi

September 2014: Two posters on Forest Owlet study were presented by both the M.Sc students at Students Conference of Conservation Science (SCCS), Bangalore .

November 2014: Indian Ornithology Conference , SACON

May 2015: Conference of Department of Science and Technology, Hyderabad

December 2014 : Wildlife Institute of India, Dehradun. Invited talk.

January 2015 : Pakshi Mitra Sameelan, Pune

September 2015: Our study findings were presented by WRCS researcher at SCCS, Bangalore.

September 2016 : Mr. Akshay Anand presented the findings of the study at Students Conference of Conservation Science (SCCS), Bangalore

September 2017 : Dr. Mehta presented the findings of the study to the Principal Chief Conservator of Forests, Madhya Pradesh.

October 2017: One of the M. Sc student presented the findings of her disseratation on the Forest Owlet at SCCS International Conference in China.

## Awareness Workshops on Owls

December 2014: A workshop for the field staff of East Kalibhit Range, Khandwa District. Range officer and 14 field staff participated in the workshop. The workshop included class room and field session on identification of different types of owls found in the study area.

December 2015 : A workshop was organized for the Forest Officers and field staff of Khandwa, Burhanpur and Betul Divisions where the forests are being managed for timber harvesting.Three senior officers including Chief Conservator of Forests, Khandwa, Conservator of Forests and Deputy Conservator of Forests participated in the workshop. 130 field staff from three divisions were also presented in the workshop. During the workshop, guidelines were prescribed for protecting cavity-bearing trees and nest trees of owls. This is a major achievement of the study as it has brought wildlife conservation in managed forests.

## August 2013 to June 2017

Training of Students in Ecology of Forest Owlet

During the study, we trained totally 14 students in various aspects of the study. This included 9 post-graduate students and 5 graduate students. The students could get an opportunity to learn occupancy and population monitoring, call broadcasting survey, color-banding and radio-tagging and tracking of Forest Owlets, pellet analysis, data analysis, data preparation, paper writing and report writing.

## November 2013 to June 2014

Master's Thesis on the ecology of Forest Owlet

Two students pursuing Master's degree in Ecology Course at Pondicherry University carried out their dissertation on two aspects of the Forest Owlet.

Ms. Megha Rao worked on the nest site selection by the Forest Owlet in the study area

Ms. Ridhi Chandarana worked on the diet of Forest Owlet in the study area.

## Popular Articles

Dr. Mehta has written two popular articles on owls. One was published in SAVEUS magazine and the other was published in Indian Forester Journal.

## Public Awareness Posters on Owl Conservation

We made public awareness posters on owl conservation. The posters were displayed on SH 26, villages, schools and Range offices in the study area.

## Community Initiative through Athena

To involve farmers in conservation of owl nest sites in their farms, we formed women's Self Help Group (SHG) in the study area. The women are being trained in making owl-themed handicraft products such as bags, key chains, pillow covers, cushion covers. WRCS helps in marketing the products in order to generate income for the SHGs and thereby seeking their support in owl

conservation in their area. Currently, there are 2 SHGs in the study area comprising of 6 women. The families of these women have assured in protecting the owls and their habitat. This is a novel initiative and is earning good will for the owls in the study area. This work needs to be continued to get the support of local people for owl conservation.

WRCS

Wildlife Research and Conservation Society