

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

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The Authors

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Executive Summary

The Forest Owlet *Athene (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 Peregrine 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 km² 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 owl in the study area. Of these, 18 survey units were in a compact cluster and were selected because it had presence of forest owl 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 49 Forest Owlets in the study area. This included 23 females, 18 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 56 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 detect totally 16 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 *Bridelia retusa*, 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 nonbreeding male and 1 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 birds 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 owl. 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 capture in the area, there is a lot of interest in owl capture and 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 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 appliques. 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

3 more research papers from this study area already under preparation

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

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

Through this project, we have been able to train several 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 *Athene (Heteroglaux) blewitti* is a small, 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. This specimen is in the American Museum of Natural 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 Maharashtra. 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 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 of 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 Khandwa 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



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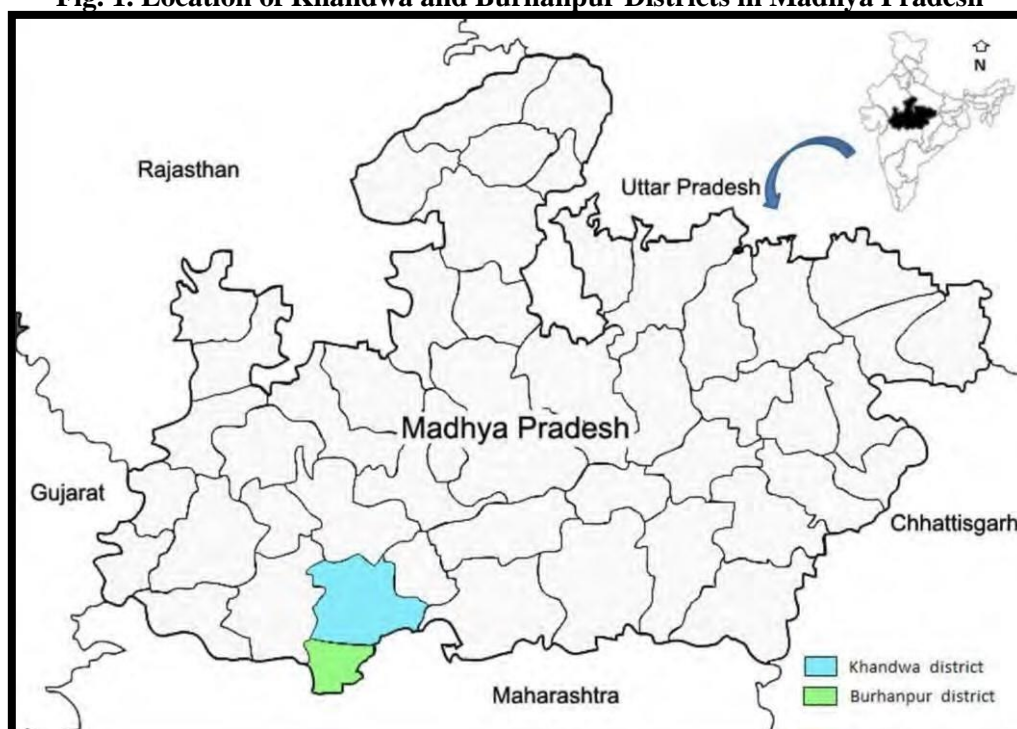
Chapter Two

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 km². 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 midJune 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°C while the minimum temperature during winter can dip to 7°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 coromandelica*, *Terminalia alata*, *Butea monosperma*, *Diospyros melanoxylon*, *Boswellia serrata*, and *Garuga pinnata*. Bamboo is found mainly in hilly region of the area. *Wrightia tinctoria*, *Helicteris isora*, *Zizyphus 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



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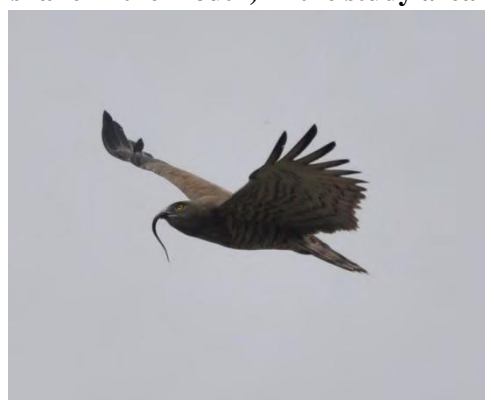
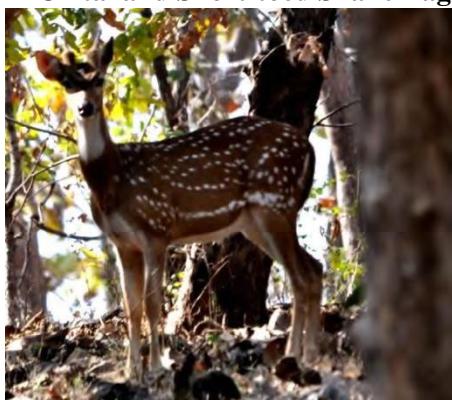


Jayant Kulkarni /WRCS

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 seen frequently in the area. There are eight species of owls in the area, including the Forest Owllet which is a Schedule I species, Spotted Owllet, Jungle Owllet, 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 Owllet 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

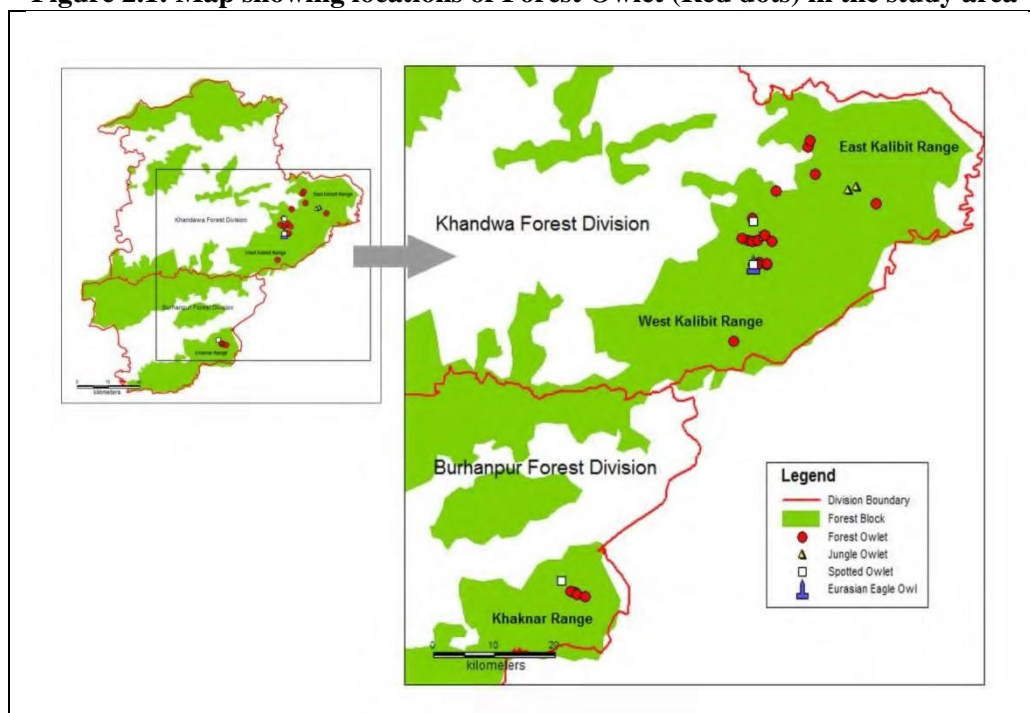


Table 2.1: Detection of Forest Owlet During Rapid Survey (March to June 2013)

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)

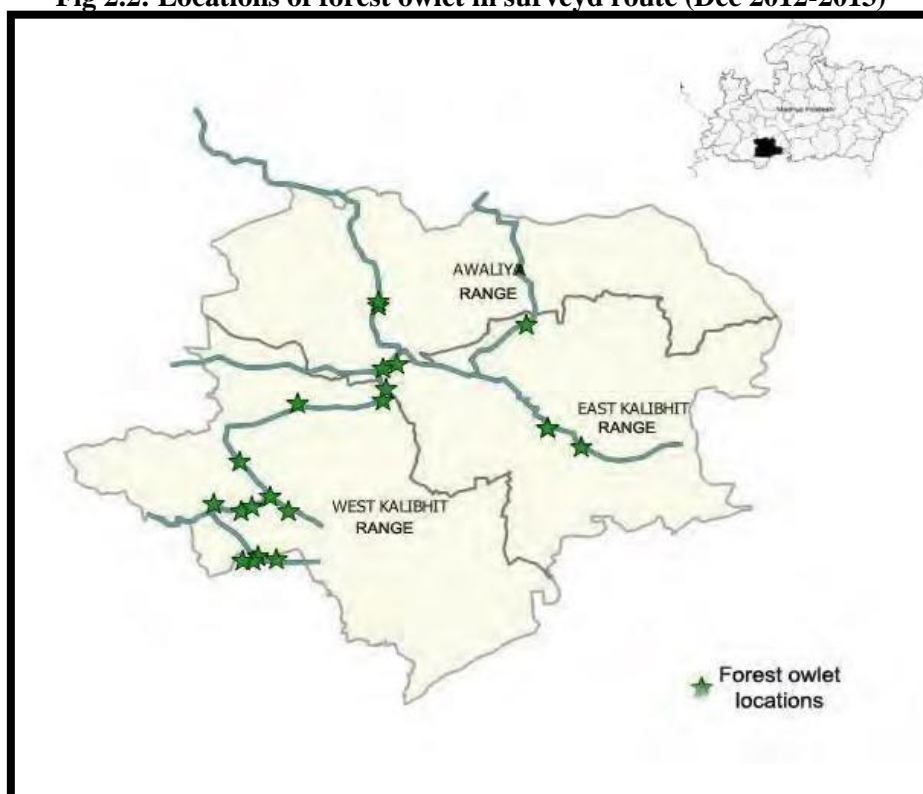
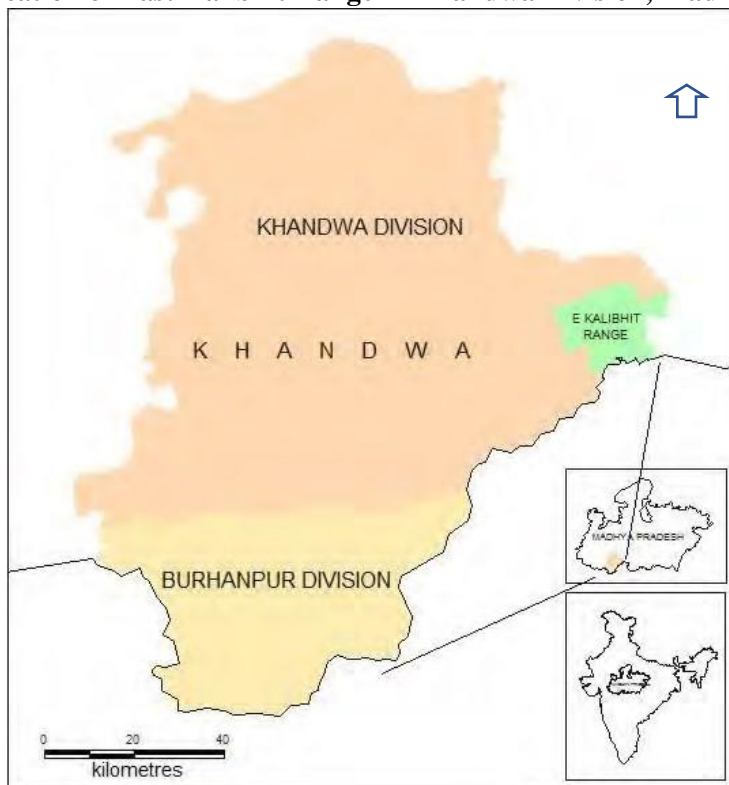


Fig.2.3 :Location of East Kalibhit Range in Khandwa Division, Madhya Pradesh

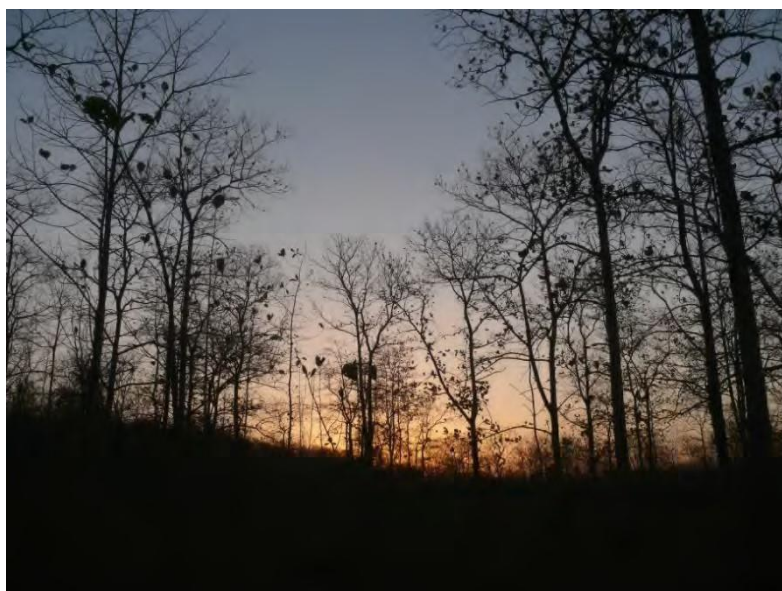


2.4 Selection of Grids for Monitoring Forest Owlet Occupancy

After a rapid survey of the area, we selected a compact area of about 100 km² 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 into 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

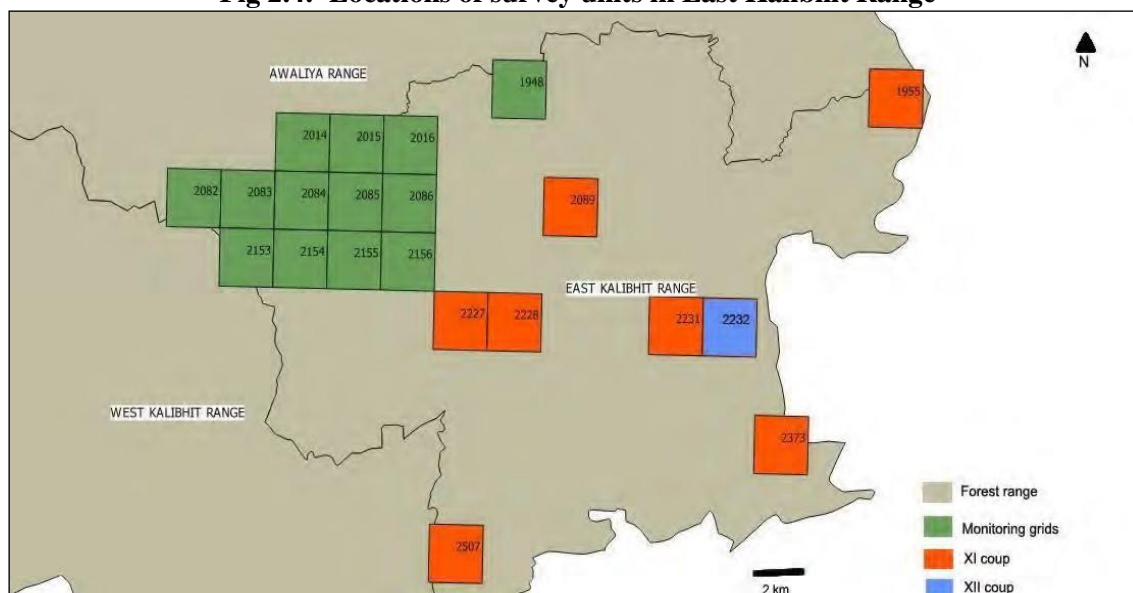


Table 2.2: Details of Survey Units in the Study Area

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

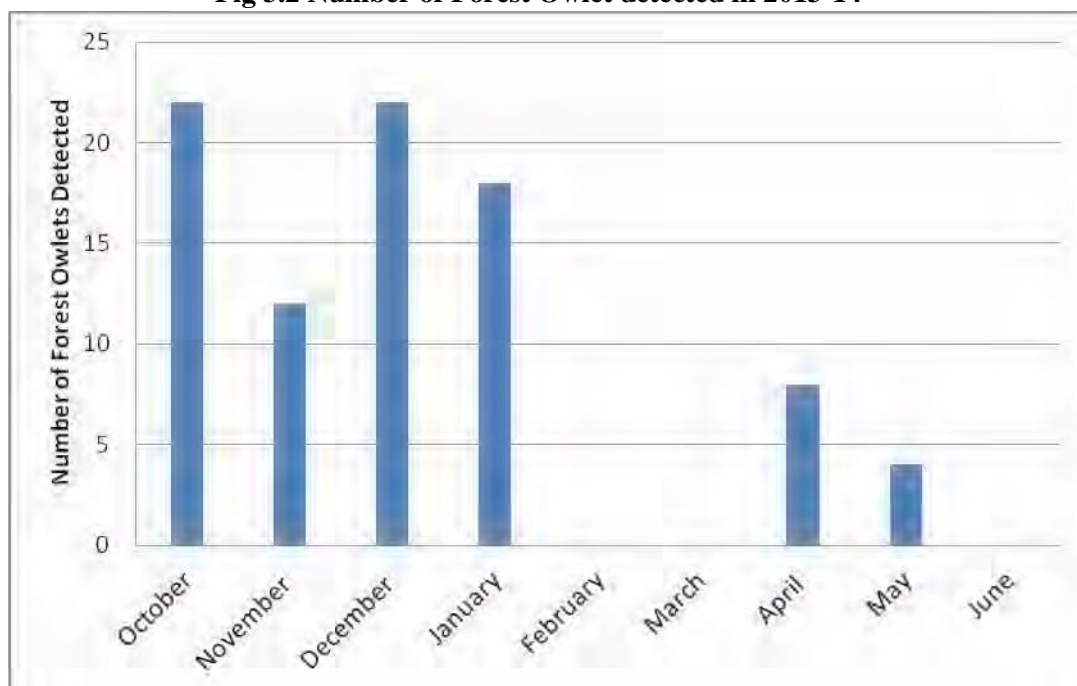
The number of owls detected throughout the four years of the study fluctuated. The study area being relatively small the total number of owls detected over the four years was also small. We calculated the total number of owls per month that were located within the study area.

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 of 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 m² 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





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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-anding.
- 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

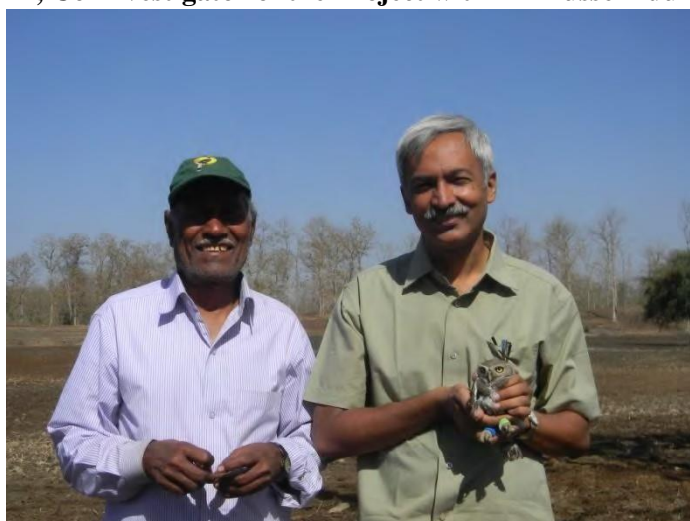
- For the female, we used red colored band on the right leg
- For the male, we used blue colored band on the right leg
- For the juvenile, we used green colored band on the right leg

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 49 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	Vikrampur a	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	Loodiyabab a	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	Green/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	Vikrampur	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

Profile of Bhoujudana Male (BDM1) Location:

Bhoujudana. Banding Date: 25-2-14 Sex: Male

Breeding Status: Paired with BDF1. Copulation seen on 11-12-13.



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



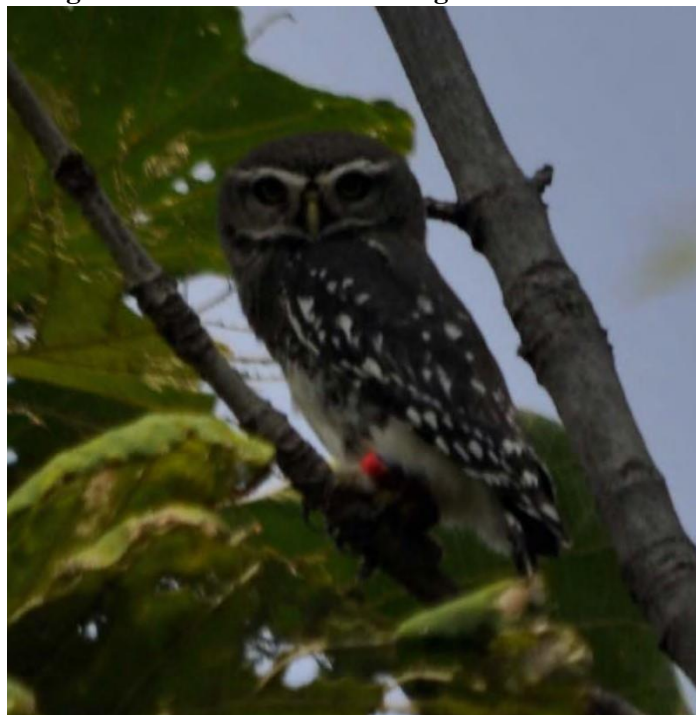
Profile of Barajoshi Female 1(BJF1).

Location: Barajoshi-2083. Banding Date: 4-4-13 Breeding Status: Paired with BJM1, Juvenile seen in December 2013.



Profile of 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)

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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.

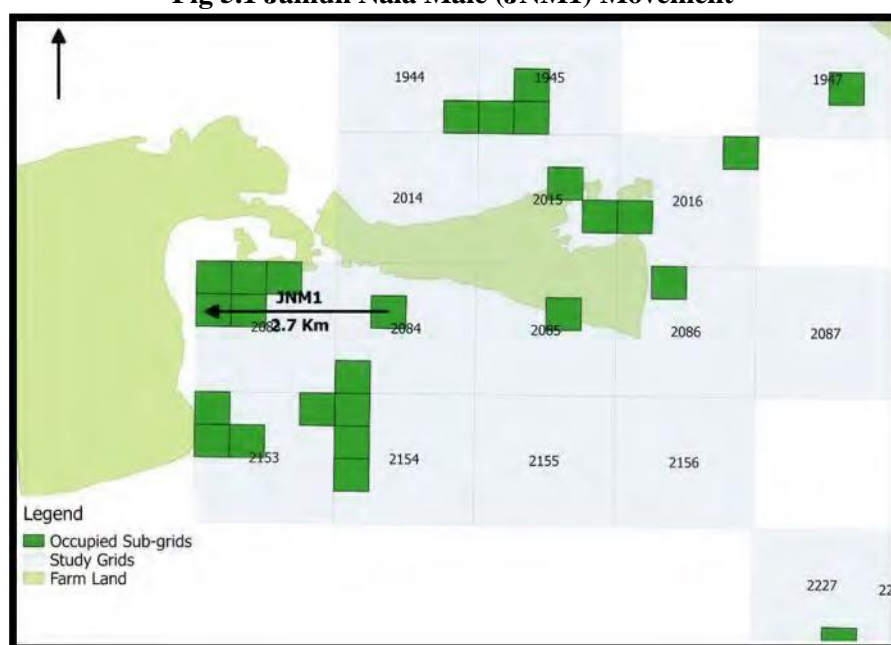
5.2 Methodology

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

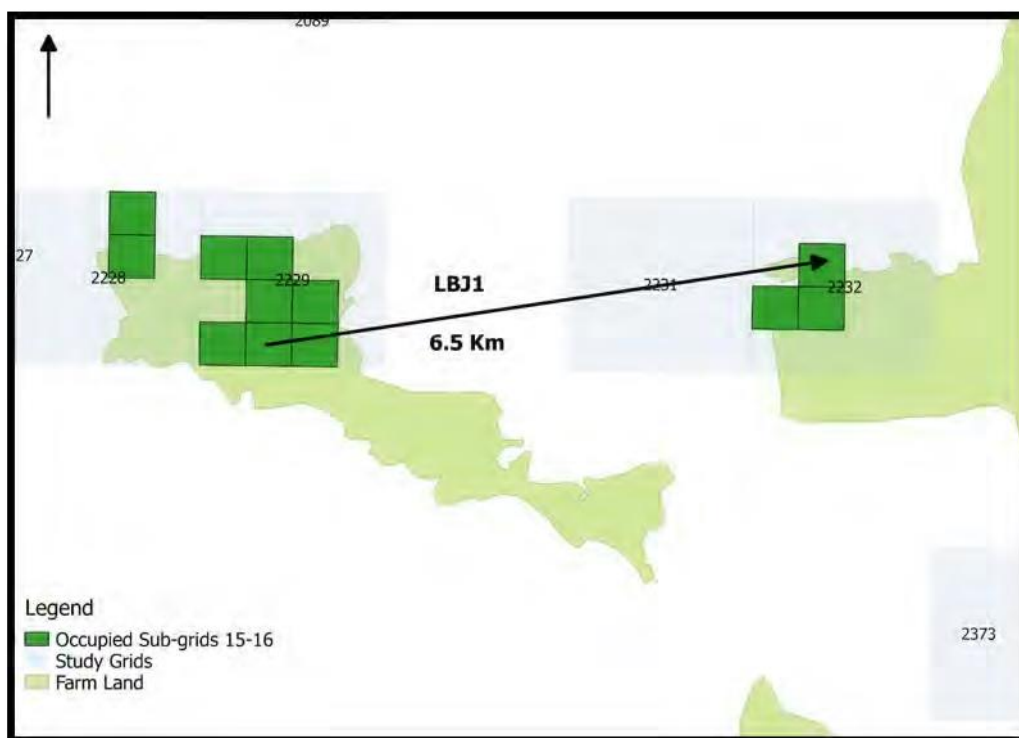
There were three cases where a banded bird has moved from one location to another within the study area. The first instance of this was seen during the 2014-2015 season. The male that was banded in 2084-Peerbaba in the Jamun-nala (32626) location had moved 2.7 km to the Barajoshi (32621) location in the 2083-Kuanala grid. During that period, the Barajoshi location was occupied by BJJ1.

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 17th 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.

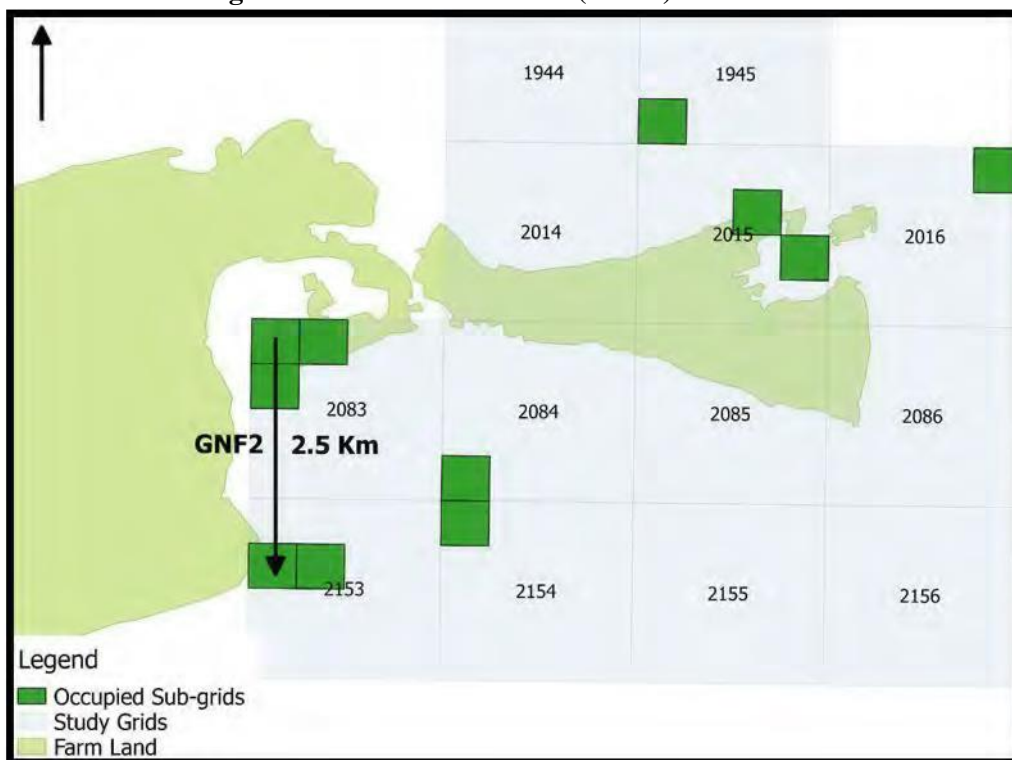
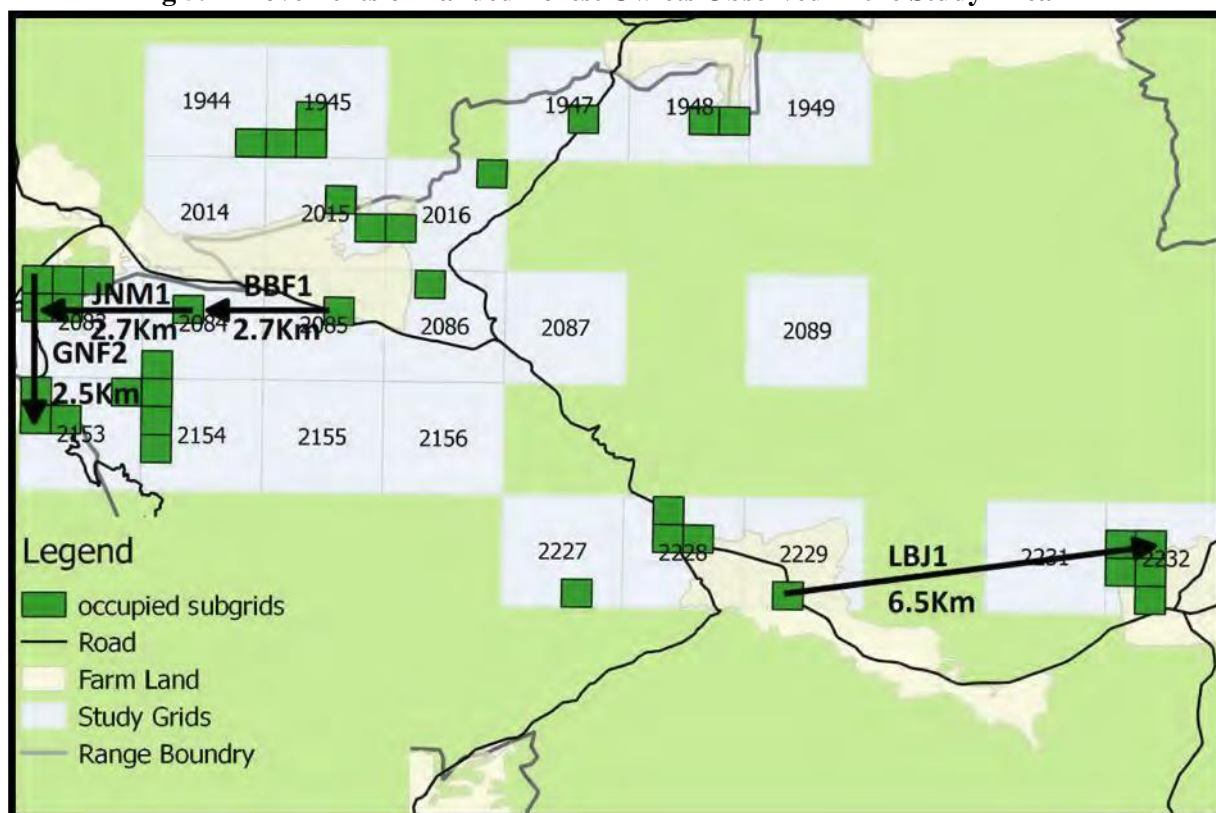


Fig 5.4 Movements of Banded Forest Owlets Observed in the Study Area



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

- Forest Owlets continue to occupy their territories till Monsoon.
- Post-monsoon, 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 dispersed and there were not many recaptures of the juveniles.
- Each season, we observed a few unbanded birds in the area. This indicates that the Forest Owlet have localized movement patterns.



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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	07-102013	250 Turning(2153)	DTF1	250 TurningKekada	250 TurningKekada	NA	250 TurningKekada	Bird retained territory. Present for 3 years after banding.
2	10-122013	Bhag Pura- 2014	BPF1	Bhagpura	NA	NA	NA	
3	28-122013	Peer Baba-2084	PBJ1	Peerbaba	NA	NA	NA	
4	04-012014	Banda Baba-2085	BBJ1	Bandababa	NA	NA	NA	
5	25-022014	Kua Nala-2083	KNM1	Kuanala	Kuanala	NA	NA	Territory retained. Present for 2 years after banding.
6	25-022014	Bhajudana	BDM1	Bhajudana	NA	NA	NA	
7	25-022014	Kher Baba- 1873	KBM1	Kherbaba	Kherbaba	NA	Kherbaba	Territory retained Present for 3 years after banding.
8	26-022014	Barajoshi- 2083	BJM1	Barajoshi				Bird died in Road Kill in the 2 nd year.
9	26-022014	Mehlu Road- 2086	MRF1	Mehlu Road	NA	NA	NA	
10	28-022014	Jhanda baba- 2084	JBF1	Jhandababa	NA	NA	NA	
11	28-022014	Jamun Nala- 2084	JNM1	Jamunala	Barajoshi	NA	NA	Bird moved Present for 2 years after banding.
12	01-032014	Govind Nala- 2083	GNM1	Govindnala	NA	NA	NA	
13	01-032014	Govind Nala- 2083	GNF1	Govindnala	NA	NA	NA	
14	01-032014	250 Turning-2153	DTJ1	250 TurningKekada	NA	NA	NA	

15	02-032014	Mehlu Road- 2086	MRM1	Mehlu Road	Bhagpura	NA	NA	Bird moved. Present for 2 years after banding.
16	02-032014	Lokad Gogra- 2154	LGF1	Lokadgogra	Lokadgogra	NA	NA	Retained territory. Present for 2 years after banding.
17	03-032014	Jamun Nala- 2084	JNF1	Jamunala	NA	NA	NA	
18	03-032014	Peer Baba-2084	PBM1	Peerbaba	Peerbaba	Jhandababa	Jhandababa	Bird moved to another location in the same grid. 200 m distance.
19	08-042014	Jhinjari- 2232	JHF1	Jhinjri	NA	Jhinjri	Jhinjri	Retained territory. Present for 3 years after banding.
20	08-042014	Jhinjari- 2232	JHM1	Jhinjri	NA	NA	NA	
21	09-042014	250 Turning-2153	DTM1	250 TurningKekada	NA	NA	NA	
22	11-042014	Vikrampura-1949	VKM1	Vikrampura	NA	NA	NA	
23	16-042014	Jhanda baba- 2084	JBM1	Jhandababa	NA	NA	NA	
24	18-042014	Jhinjari- 2232	JHM2	Jhinjri	Jhinjri	NA	NA	Retained Territory. Present for 2 years after banding.
25	17-122014	Kekada- 2153	KDF1	NA	kekada	NA	NA	Retained territory. Present for 2 years after banding.
26	17-022015	Bagda- 2228	BGF1	NA	Bagda	NA	NA	Retained territory. Present for 2 years after banding.
27	18-022015	Harda river-West Kalibhit	HRF1	NA	Harda River	NA	NA	

28	09-042015	Govind Nala-2083	GNF2	NA	Govindnala	Kekada	NA	Bird moved. Present for 2 years after banding.
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29	11-042015	Kula Bura- 1945	GRF1	NA	Kula Bura	NA	NA	Present for 1 year after banding.
30	16-042015	Kaudi- 2232	KUJ1	NA	Kaudi	NA	NA	
31	17-042015	Kua Nala-2083	KNF2	NA	Kuanala	NA	NA	
32	22-042015	Jhinjari- 2232	JHM3	NA	Jhinjri	NA	NA	
33	14-052015	Jhinjari- 2232	KUM1	NA	Kaudi	Kaudi	Kaudi	Bird Retained territory. Present for 2 years after banding.
34	27-052015	Ludiyababa- 2229	LBJ1	NA	Ludiyababa	Jhinjri	NA	
35	28-112015	Ghoghraghat- 2016	GGF1	NA	NA	Gograghat	NA	
36	17-122015	Kaudi- 2232	KUF1	NA	NA	Kaudi	Kaudi	Bird retained territory. Present for 2 years after banding.
37	17-122015	Bagda- 2228	BGM1	NA	NA	Bagda	Bagda	Bird retained territory. Present for 2 years after banding.
38	05-032016	Ludiyababa- 2229	LBJ2	NA	NA	Ludiyababa	NA	
39	19-032016	Kekada- 2153	KDF2	NA	NA	Kekada	Kekada	Bird retained territory. Present for 1 year after banding.
40	24-032016	Ludiyababa- 2229	LBM1	NA	NA	Ludiyababa	Ludiyababa	Bird retained territory. Present for 1 year after banding.

41	24-032016	Ludiyababa- 2229	LBF1	NA	NA	Ludiyababa	NA	
42	02-042016	Bagdeballa- 2229	BLF1	NA	NA	Bagdeballa	NA	
43	04-042016	Bagdeballa- 2229	BLJ1	NA	NA	Bagdeballa	NA	
44	22-042016	Ludiyababa- 2229	LBJ3	NA	NA	Ludiyababa	NA	
45	22-112016	Barajoshi- 2083	BJF2	NA	NA	NA	Barajoshi	Bird retained
								territory. Present for 1 year after banding.
46	26-112016	Ludiyababa- 2229	LBM2	NA	NA	NA	Ludiyababa	Bird retained territory. Present for 1 year after banding.
47	09-122016	Ludiyababa- 2229	LBF2	NA	NA	NA	Ludiyababa	Bird retained territory. Present for 1 year after banding.

NA indicates no information.

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)

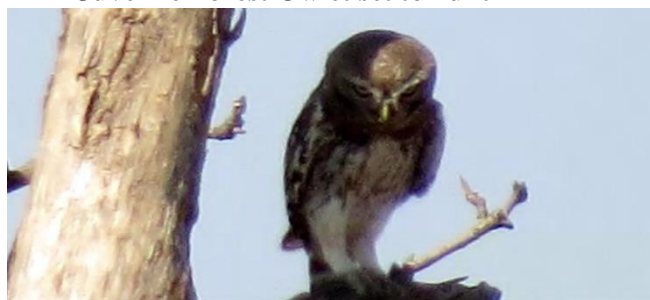
6.3 Prey Identification

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)



Insect remains



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Reptile Remians



Bird Remains



Amphibian Remains



Mammal vertebrate

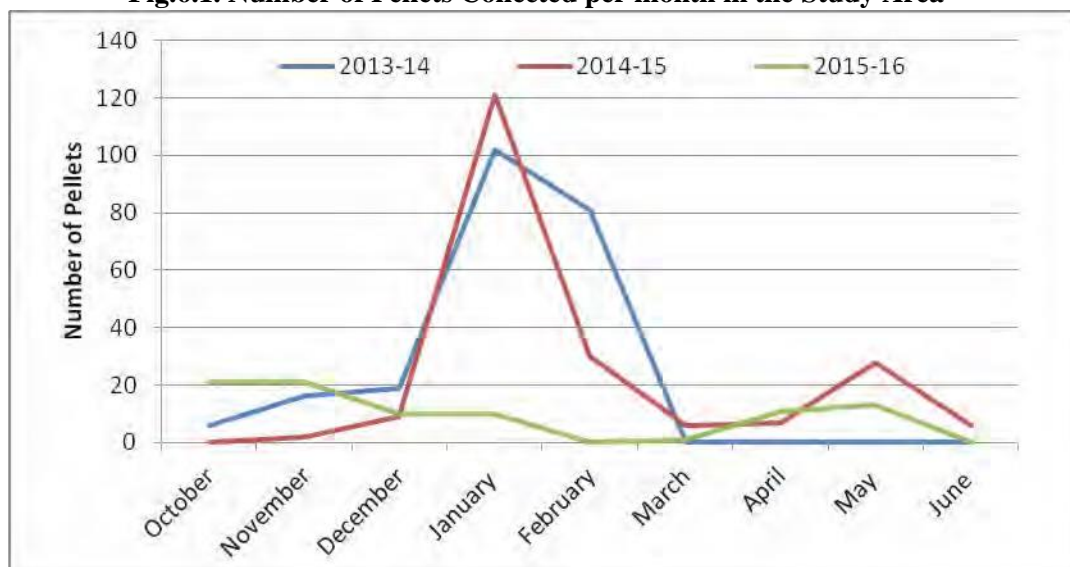


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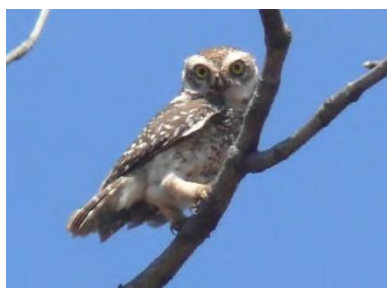
Table 6.2 Number of Forest Owlet Pellets and Prey Remains

	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 owl (*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 owl (230), spotted owl (110) and jungle owl (38) in the study area. The prey remains were separated, identified and quantified to construct the diet profile of the Forest Owllet and compared with that of the Spotted and Jungle Owllet.

6.6 Results

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

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

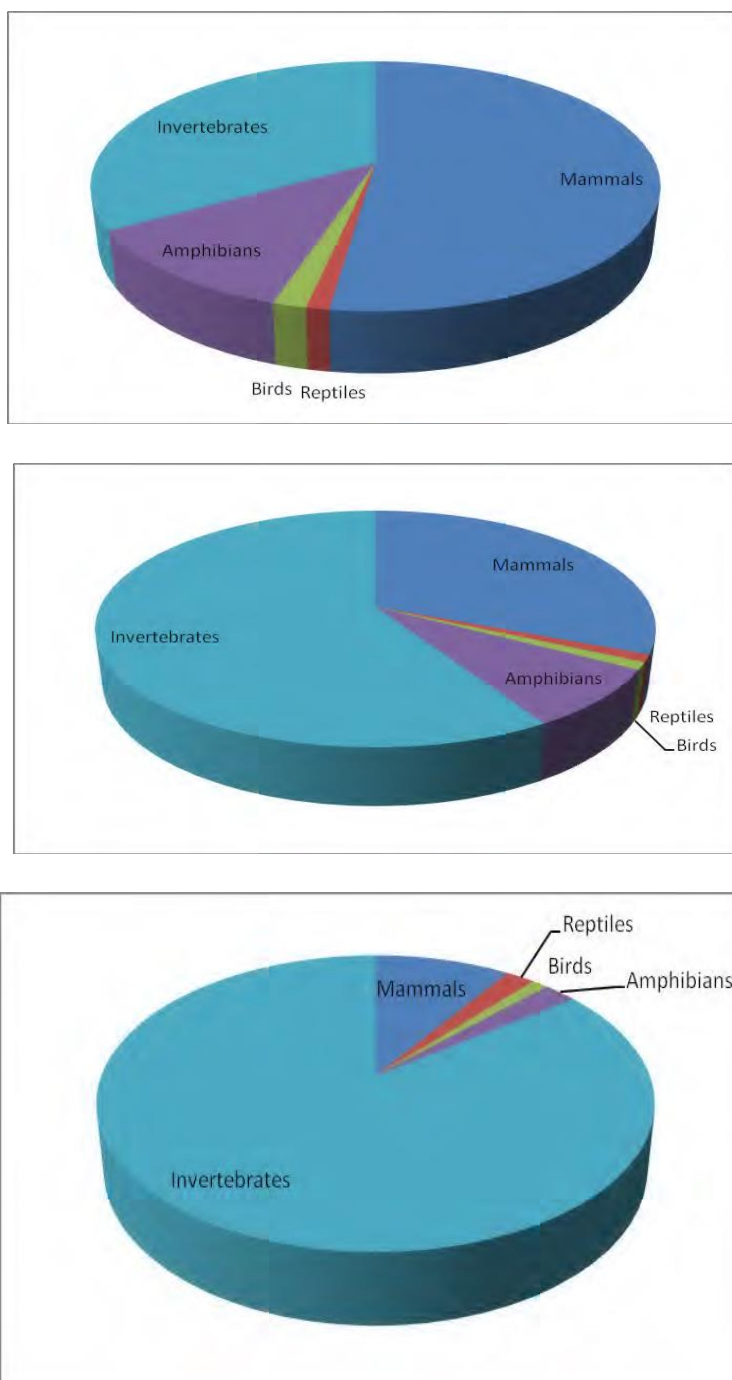


Fig: 6.2 Comparison of Percent Prey Frequencies in the diet of Forest, Spotted and Jungle Owllet

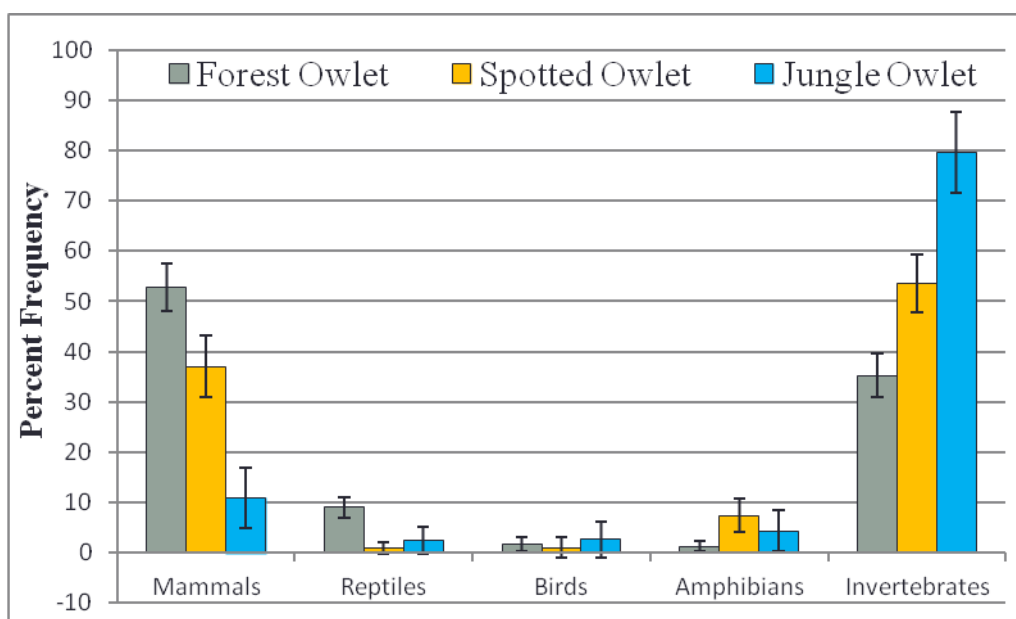


Table 6.3: Mean Prey Biomass in the diet of Forest owl, Spotted owl and Jungle Owllet

		Forest Owllet	Spotted Owllet	Jungle Owllet
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

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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 caches it in a cavity for later use.

Forest Owlet Pair at Barajoshi



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. Mean Vegetation Parameters (\bar{x}) at the Forest Owlet Nest Sites (N=75)

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

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

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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 be studied using three well established techniques, 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 same 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 24th and 28th 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.

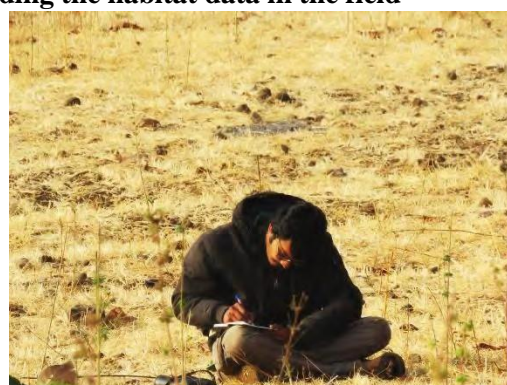
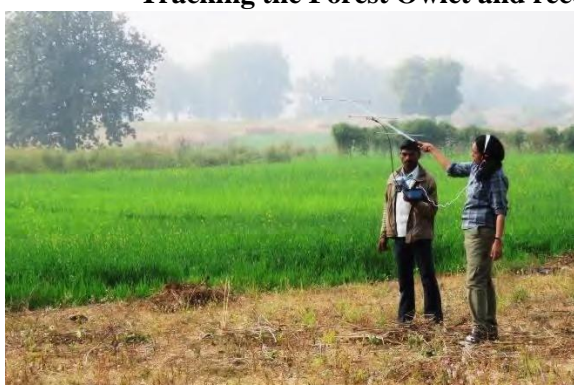
Tracking of radio tagged birds can be done through two techniques, i.e. triangulation and direct monitoring. We employed direct monitoring as it proved to give more significant data. The three tagged birds were monitored once every week for a period of 10 hours per day. Monitoring would start at 7 AM 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 600m².

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

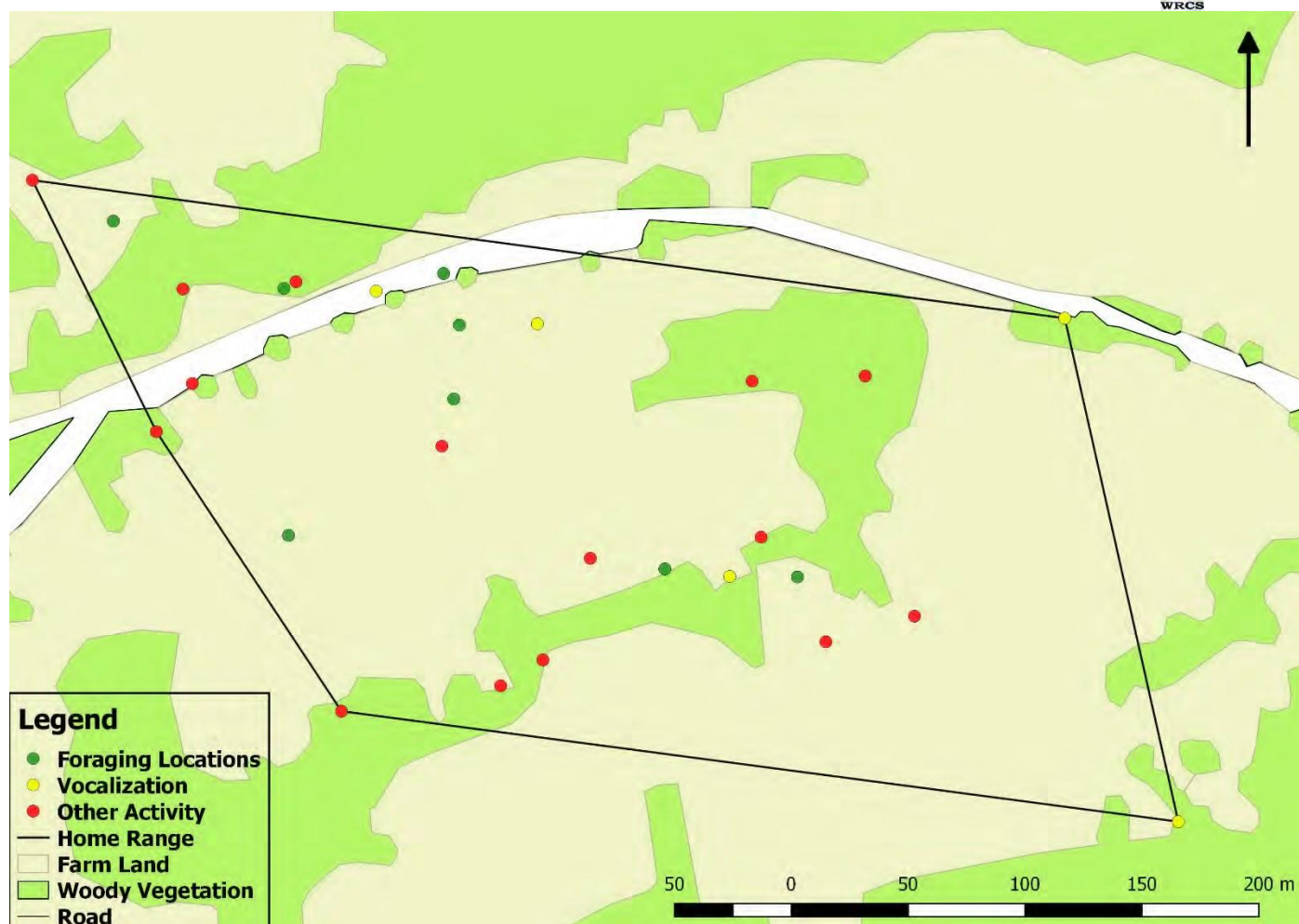
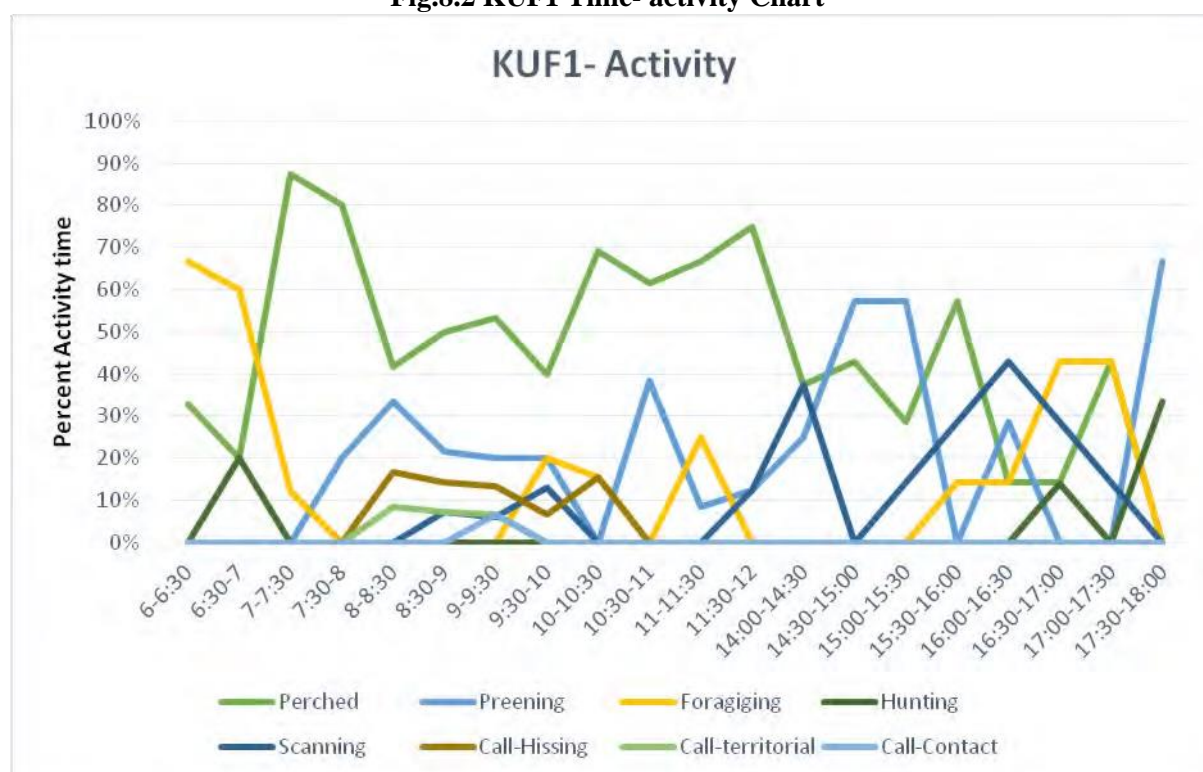


Fig.8.2 KUF1 Time- activity Chart



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)

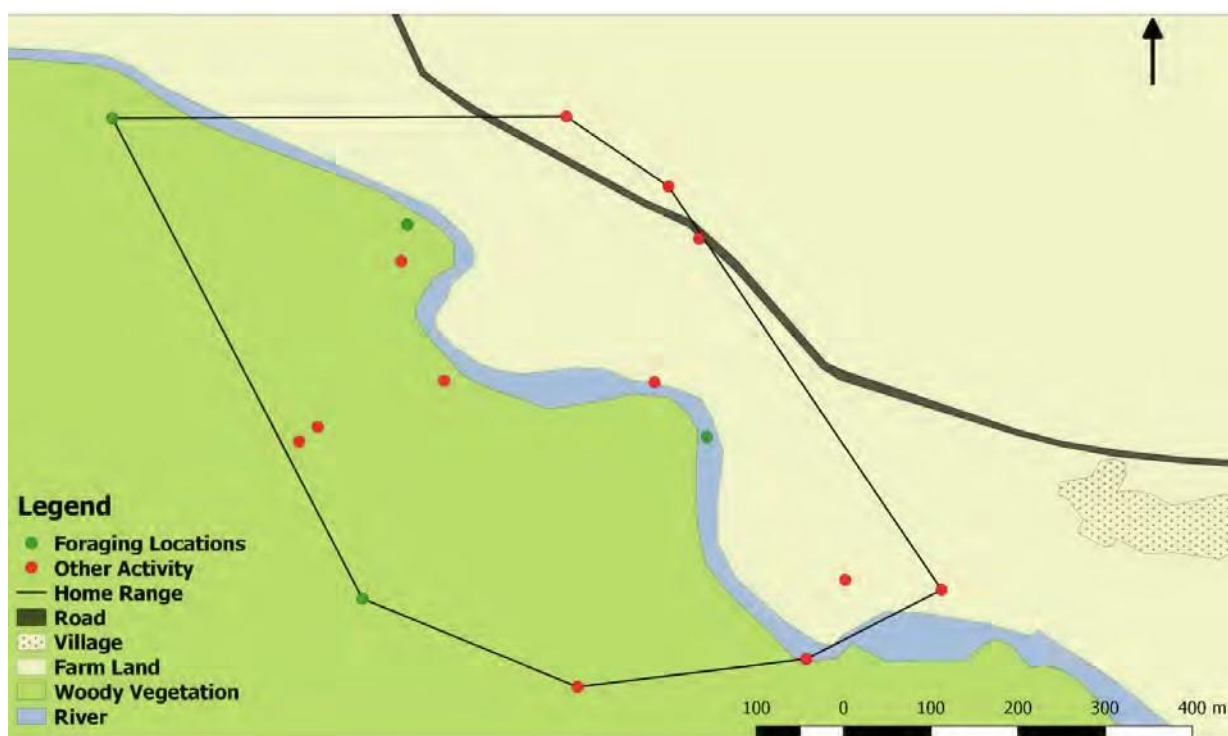
The male at Theklech s was a breeding male which was raising 2 juveniles. This male used a larger territory than the Kaudi female. The average movement of the male during a day was 314m, with the longest distance moved in a day being 764m. The area within of his home range was 860m². This was considerable 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



Fig. 8.3 Map of Locations of TPM1

Prachi Mehta/WRCS



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%
Foraging		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.

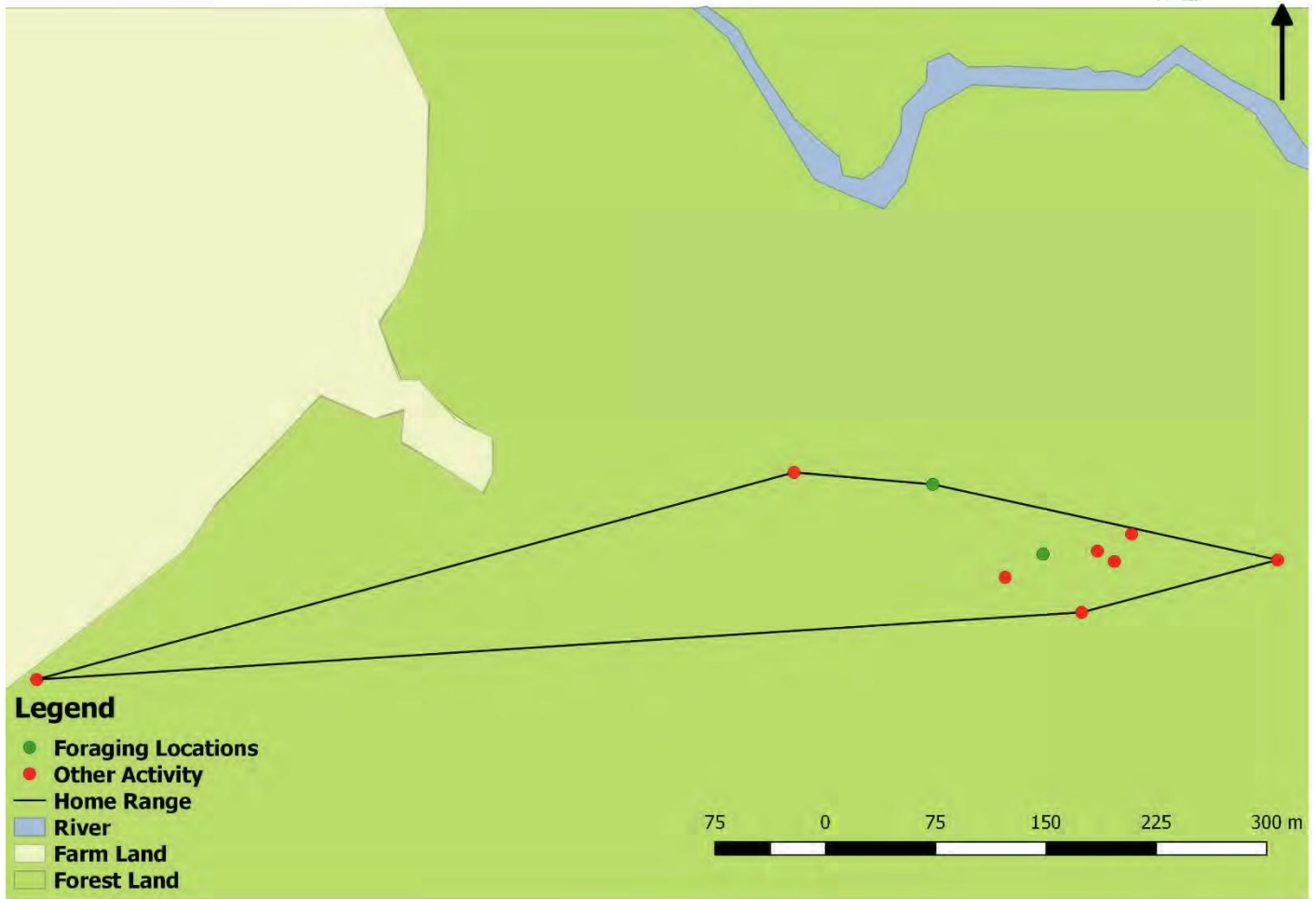
DTM1. Transmitter and antenna visible on the right side.



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 860m² . KUF1 had a home range of 640m².



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 selfconsumption 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.

उल्लहमारे दोस्त श्खरं में (School of Owls) क्रमांक १ : उल्लक 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 owl 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 owl 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.

उलूका घर (House of Owls) दिसम्बर ०१५ (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 owllet 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 owl. 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







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
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Protection of Cavity Trees	<p>Prior to marking cavity trees, the area around the tree and on the tree should be checked for nesting signs.</p> <p>If any cavity trees are marked for felling , then the field staff checks for nesting status and should contact the WRCS team for confirmation.</p>	<p>Marking field staff</p> <p>CCF Khandwa CF Khandwa, DCF(Production) and Marking field staff.</p>	<p>October to May</p> <p>October to May</p>
For Nest tree Protection	<p>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.</p> <p>All known nest and roost trees will be marked for protection. numbered.</p>	<p>Production field staff and WRCS team</p> <p>CCF Territorial, DFO Production and WRCS team</p> <p>WRCS team in collaboration with the Range Officer of the area and the beat guards of the location</p>	
	<p>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.</p>	<p>WRCS team, Range Officers, beat guards and Members of the VFCs.</p>	<p>October to March</p>
For Controlling the use of Rodenticides	<p>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.</p>	<p>WRCS team along with beat guards</p>	<p>October to April</p>

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 described earlier, there is considerable tree cutting by local people in the study area. This certainly creates an impact on the survival of the Forest Owllet 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 Owllet, Spotted Owllet, Jungle Owllet, 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 handicraft 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	1 st Progress Report
December 2013	2 nd Progress Report
March 2014	3 rd Progress Report
June 2014	4 th Progress Report
May 2015	5 th Progress Report
September 2015	1st Annual Report
March 2016	6 th Progress Report
June 2016	7 th Progress Report
September 2016	2nd Annual Report
January 2017	8 th Progress Report
June 2017	9 th 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 “ उल्लूका 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 measures required .

September 2017 : We have published a technical manual on identification of prey remains from owl pellets. The 200 page manual includes details on different categories of owl prey including mammal, reptiles, bird, amphibian and invertebrate, with identification keys for each taxon. This is the 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 dissertation 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

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