INVESTIGATION OF SELECTED STRIGIFORMES AND EVALUATION THEIR CON-SPECIFIC CALL RESPONSE, INTERSPECIES RESPONSE AND HABITAT PREFERENCE IN WAYANAD WILDLIFE SANCTUARY, KERALA.

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KERALA, INDIA

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DISSERTATION

Submitted in partial fulfillment of the requirement for the degree of

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CENTRE FOR WILDLIFE STUDIES

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

POOKODE, WAYANAD -673576

KERALA, INDIA

DECLARATION

I hereby declare that this dissertation titled **"Investigation of selected strigiformes and evaluation their con-specific call response, interspecies response and habitat preference in Wayanad wildlife sanctuary, Kerala."** is a bonafide record of research work done by me during the course of my Master's research program and the dissertation has not previously formed the basis for the award of any degree, diploma, associateship, fellowships or other similar title of any other University or Society.

Place: Pookode **Aswin Sai K. V.**

Date**:** **(18-MSVP-07)**

CERTIFICATE

Certified that this dissertation, titled "**Investigation of selected strigiformes and evaluation their con-specific call response, interspecies response and habitat preference in Wayanad wildlife sanctuary, Kerala"** is a bona fide record of research work done independently by **Aswin Sai K V (18-MSVP-07)** under my guidance and supervision and that it has not previously formed the basis for the award of any degree, diploma, associateship or fellowship to him.

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Date:

Dr. Rajani C. V.
(Major Guide)

CERTIFICATE

We the undersigned members of the Advisory Committee of **Aswin Sai K V (18-MSVP-07)**, a candidate for the degree of Master of Science in Wildlife studies, agree that the dissertation titled, "**Investigation of selected strigiformes and evaluation their con-specific call response, interspecies response and habitat preference in Wayanad wildlife sanctuary, Kerala"** may be submitted by **Aswin Sai K V (18-MSVP-07),** in partial fulfillment of the requirement for the degree.

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TABLE OF CONTENTS

Chapter	Title	Page No.
	List of Figure	**Viii**
	List of Tables	**IX**
	List of plates	**X**
1	**INTRODUCTION**	**1**
2	**REVIEW OF LITERATURE`**	**4**
	2.1 call playback	**4**
	2.2 call/song of owl	**5**
	2.3 about niche	**5**
	2.4 owl studies in Kerala	**5**
	2.5 habitat preference of owl	**7**
3	**MATERIALS AND METHOD**	**9**
	3.1 study area	**9**
	3.2 selected species	**10**
	3.3 study period	**11**
	3.4 survey methods	**11**
	3.4.1 dusk watch	**11**
	3.4.2 initial quiet listening	**11**
	3.4.3 call playback	**12**
	3.4.4 spot lighting	**12**
4	**RESULT**	**14**

	4.1 species inventory and species richness	**14**
	4.1.1 dusk watch	**14**
	4.1.2 quiet listening	**14**
	4.1.3 call playback	**15**
	4.1.4 spot lighting	**15**
	4.2 con-specific call response	**15**
	4.3 inter species response	**17**
	4.4 habitat- species response	**19**
5	**DISCUSSION**	**21**
6	**SUMMARY**	**27**
7	**REFERENCES**	**29**
8	**ABSTRACT**	**36**

LIST OF FIGURES

Figure no	Title	Page no
Figure 1	**Number of species present in quiet listening method.**	**14**
Figure 2	**Call playback response of selected owl species.**	**15**
Figure 3	**Average number of individual species response obtains from call playback method.**	**16**
Figure 4	**Latency of con specific call response.**	**17**
Figure 5	**Habitat- species response.**	**20**

LIST OF TABLES

Table no	Title	Page no
Table 1	Inter species interaction of owls surveyed	17

LIST OF PLATES

Plate no	Title	Page no
1	Point surveyed in Wayanad wildlife sanctuary and its different habitat.	10
2	Selected species of owl photo	12

1. INTRODUCTION

Owls are the nocturnal birds of prey found across the globe except Antarctica and Green islands. So far 243 species of owls have been reported in the world (Gill *et al.,* 2020) of which 36 species are known to be distributed in India (eBird, 2020). The owls are listed under the order Strigiformes consisting of two families: Tytonidae which include the barn, grass owls and bay owls and Strigidae which include rest of the owls and owlets. In India, the former family include four species (Barn owl, Andaman Barn owl, Eastern Grass owl and oriental bay owl) and latter include the rest of the 32 species (Grimmett *et al.,* 2016).

Owls are a fascinating nocturnal bird of prey which possesses special anatomical features such as large eyes and the great mobility of their head that can rotate up to 270 degrees (Long, 1998). They can fly extremely quiet (Graham, 1934), hear even the minute sounds (Dijk, 1972) and can see in extreme darkness (Johnsguard, 1988). These adaptations make them a perfect nocturnal predator. Rodents and insects being the major prey for the owls, owls play a role to control rodent and insect pest populations in the agricultural areas. Studies showed an increased population of owls in the agricultural lands lowers the pest population (Siva and Neelanarayanan 2018; Siva *et al.,* 2019). Hence, they are considered as farmer's friends (Fisher, 1895).

Owls are frequently considered both as a symbol of wisdom and evil. In some Indian belief, owl sight is considered as a bad omen (Modi 1911). However, in Hindu culture, Owls are the sacred vehicle for the goddess Lakshmi and being nocturnal birds they are believed to find even the darkest places and took efforts to carry the goddess to those regions (Morris, 2009). But in North India, in some cultures owls are also caught and sacrificed on the festival Diwali to honour the Goddess Lakshmi (Padhy, 2016).

Kerala had a wide variety of flora and fauna. Out of the 36 owl species present in India, only 16 species of owls are reported in Kerala (Easa & jayson, 2004). Out of the 16, three species are migratory and the other 13 are resident. But

other than these distributional records, there were only few works done in the owls in Kerala. Some of the earlier reported owl works are, acoustic related work on jungle owlet (Neelakantan 1971), brown boobook (Neelakantan 1979; Babu and Jayson 2009), distribution record of oriental bay owl (Hussain and Khan 1977; Sugathan and Jacob, 1995), short eared owl (Chandraseghar and Nameer, 2003) and pallid scops owl (Chandran *et al.,* 2016), public perspective of mottled wood owl/ “Kallan kozhi" (Vijayaragavan, 1998), predation and diet of the barn owl (Ajitha *et al.,* 2013) and breeding biology of brown fish owl (Bindhu and Balakrishnan, 2015). Some KFRI works related to owls distribution and conservation (Jayson and Sivaram, 2009). A few conference talks about owls (Jayson *et al.,* 2007; Babu *et al.,* 2008). Other than the sighing records, we cannot see much previous studies in owls in Kerala.

Owls are easily identified by their calls. The birds use their calls and songs for attracting mates, and also to defend their territory. In owls, diurnal ones are far less vocal than the nocturnal ones, because they have more vision than the nocturnal ones. Study based on sound is more critical in the case of birds which are nocturnal and secretive in nature. Furthermore, every sound they produce are species specific and unique. So the sound based study in owls is very critical for their identification. Therefore acoustics methods are very useful for surveying secretive species like owls, and also it’s more accurate in the sense that each species employs unique calls which can easily differentiate from others. Call play-back method is one of the very efficient methods used to detect nocturnal species like owls (Johnson *et al.,* 1981). Moreover, it saves time and increases detection in troublesome species, especially nocturnal species. Call play-back is as simple as playing a call of some species using a speaker and documenting all the responses. The way of responses obtained by using this method, give an account on the presence or absence of the species which in turn is dependent on whether the species is responding to a specific call or not. Call play-back surveys were effective when there were no/less wind or no rain nights (Kavanagh and Peake, 1993; Debus 1995). And also methods like quiet listening and spot light methods

were combined with the call play-back method. Quiet listening methods, which used to get the unsolicited calls before starting the call play-back method. Spot lighting method uses is a torch light to search target species at the time of quiet listening, because owls are very quiet when they fly. Dusk watch is another method which is also used for surveying owls. Because owls are nocturnal species, they start their predation after sunset. So there is a more chance to detect owl activity in this meantime.

This work envisages studying the species abundance and richness. The work is planned by employing an integration of the call play-back, dusk watch, quiet listening and spot light methods. Further, the niche partitioning of the owls can be determined using the call play-back response.

Owls are one of the least studied avian species because of their secretive nature. A major share of the publication related to owls, were on the distributional or checklist records. Other than this, ecological, biological and behavioural study areas of owls were very scanty and data deficient in most of the owl species. From this earlier data, I can contribute a little knowledge additional to this field of study.

Objectives

1. Investigate the selected Strigiformes presence in the Wayanad Wildlife Sanctuary
2. Con-specific call response of owls in the Wayanad Wildlife sanctuary
3. Interspecies response of owls using call playback method in Wayanad Wildlife sanctuary
4. Evaluate habitat preference of owls in Wayanad Wildlife sanctuary

REVIEW OF LITERATURE

2.1. CALL PLAY BACK

Johnson *et al*. (1981) compared different sampling methods in avian census and suggested that call play-back method is efficient as it saves time and increases detectability in troublesome species, especially nocturnal species.

Kavanagh & Peake (1993) stated that the effectiveness of the call play-back method depends on some variables like wind and rain. Call play-back surveys were effective when there is no/less wind or no rain nights.

Debus (1995) stated that call play-back methods can be used as a high detection method for owl surveys. And also he said that windy and rainy nights can't give accurate data because of the noise which affects the owl detection.

Cooke *et al*. (2017) suggested that during call playback surveys, response of the owls were more. But the factors that play a major role in detection of the species are mainly depended upon the season where the survey was conducted and the temperature conditions. In addition, predators like owls monitor, landscape changes and the impacts on biodiversity limit the bird's land utility which results in their poor detection rate.

Zuberogoitia *et al*. (2020) opined that call play-back method is a useful survey method for the night crawling species like owls. But there are some limitations as well. There are some protocols available for surveying owls which described the best methods to obtain valid data on owls' distribution and their abundance. These protocols were confirmed by testing the response of owls to play-back calls, using wild and unknown individuals which were only noticeable when these were vocalizations given/detected. Therefore, there is no clear agreement on the best method for surveying owls. The authors tested some protocol which targeted tawny owls. Initially, radio-tracked about 20 individuals and those birds were later released into two areas in wild. Subsequently, the survey and the detection or the response rate of the radio-tagged individuals were carried and analyzed. The study

recorded a high responding species rate probably due to their mating pairs also responding to the broadcasting calls as a protection to their territory. The study also documented that the birds seemed to approach the broadcasting source during the survey.

2.2. CALL/SONG OF OWL

Neelakantan (1979) recorded the call of the juvenile Brown Hawk Owl in different parts of Kerala. These voices were identified as the food calls of the juvenile Brown Hawk Owl.

Wemmer and Derrickson (1994) documented the acoustics of the great horned owl in Nagarhole National park, Karnataka. As per the records, his documentation was considered as the first documentation of duetting of great horned owls in India.

Rasmussen and Ishtiaq (1999) published an observational report of vocalizations as well as the behaviour of the two pairs of forest owlets in Maharashtra, India.

Ramanujam (2003) published a paper on the long call of the Indian Eagle Owl in Pondicherry, India. The long call targeted the individuals of the Indian Eagle Owl as it was their characteristic feature.

2.3. ABOUT NICHE

Yosef *et al*. (2010) studied the interspecific interactions of forest owlet in the Melghat Tiger Reserve, Maharashtra. They observed the interactions such as the reaction of other birds towards the call play-back of the forest owlet, and on the basis they suggested that forest owlet as a predator species. The work also inferred that forest owlet spent time in anthropogenically disturbed area for predation. Interestingly, forest owlets use other large birds and cattle for spotting ground-dwelling prey species. .

2.4. OWL STUDIES IN KERALA

Neelakantan (1971) described and documented the food call of the young Malabar jungle owlet.

Hussain and Khan (1977) published a new subspecies of oriental bay owl from Kerala.

Neelakantan (1979) reported the call of the juvenile Brown Hawk Owl in different parts of Kerala. Those voices were identified as the food calls of the juvenile Brown Hawk Owl.

Sugathan and Jacod (1995) published the further distributional record of the oriental bay owl from Kerala.

Vijayaragavan (1998) published people's perspectives about owls in Kerala. Mottled wood owl is known as the “Kallen kozhi” in Kerala which means the call of the mottled wood owl brings bad things or death.

Chandrasegara and Nameer (2003) documented the significant distributional record of the short-eared owl in Malappuram, Kerala.

Ajitha *et al* (2013) published the diet of Indian barn owls, they suggested that grey musk shrew was one of the favorite prey species of barn owl in Calicut, Kerala.

Bindu and Balakrishnan (2015) published the first breeding study of brown fish owls in Kerala. The breeding season of the brown fish owls ranged from the mid of November to the mid of the April.

Chandran *et al* (2018) published the sighting record of pallid scops owl in Kerala. Further, they provided photographic key identification features for distinguishing pallid scops owl from any other scops owl.

Jayson *et al* (2007) studied the status and habitat utilization of owls in the Western Ghat region.

Babu *et al* (2008) studied the ecological niche modeling of two sympatric owls (Indian scops owl and Brown boobook) in Western Ghat region.

Jayson and Sivaram (2009) published a checklist of Western Ghats forest owls data along with behavioral, ecological and habitat modeling for the conservation of owls of the area. They found that about 16 species of owls were present in the Western Ghats region including Kerala and Tamilnadu states.

Babu and Jayson (2009) published the relation of the conspecific calls of brown boobook and its habitat response.

2.5. HABITAT PREFERENCE OF OWL

Hayward and Garton (1988) suggested that factors like difference in food, activity time, environmental factors and morphological difference between species and also the recent interspecific competitions shaped the habitat use of owls in Idaho, U.S.

Fowlie and Krüger (2003) recorded habitat preference of owls and reported that owls prefer more wide and low productive habitats which had higher polymorphism level than the closed forest ones.

Jathar and Rahmani (2012) studied the forest owlet habitat preference and utilization in Maharashtra, India. They observed that the species preferred low tree density and open canopy habitat for perching and predation. However, tall trees in high altitude forests were preferred for nesting to avoid human interaction.

Żmihorski *et al*. (2012) published an article of habitat preference of central European country farmland owls stated that, owl density was positively affected by a high percentage of grassland and built-up land, and negatively affected by the amount of fields and forests. Thus the decrease in grassland areas and increase in forest areas in Poland may negatively affect the farmland owl species.

Babu *et al*. (2019) reported that species richness and species abundance was high in unlogged places and deciduous forest patches in the Andaman Island.

Factors which triggerred the habitat preference of owls were mainly land use, patency of logging activity and the cover type. This may vary from species to species.

Fröhlich & Ciach (2019) suggested that the species richness of owls in the urban ecosystem was determined by land cover heterogeneity and was limited by noise intensity. Enhanced noise interaction may trouble the prey-predator interaction in human transformed habitats.

3. MATERIAL AND METHODOLOGY

3.1 Study area

Wayanad Wildlife Sanctuary (WWLS) is situated in the Western Ghats region and shared its boundary with Bandipur National Park and Mudumalai Tiger Reserve. WWLS is very popular for its flora and fauna.

The sanctuary was divided into four ranges namely Muthanga, Bathery, Kurichiyath, and Tholpetty (Fig 1). Anti-Poaching camps in these ranges were selected for the survey.

WWLS consisted of three types of forest habitat: moist deciduous forest, dry deciduous forest and teak dominant moist/dry deciduous forests. Most of the vegetation in those ranges were natural forest combined with teak plantation or eucalyptus plantation or both. A large area of the sanctuary consisted of moist deciduous forest. Dry deciduous forest dominant with teak plantation was mostly present in Tholpetty range while moist deciduous forest dominant in teak plantation was seen in Bathery and some of the Kurichiyath and Muthanga ranges. Muthanga range was occupied also by the combination of moist deciduous forest and eucalyptus plantation. Besides those, pepper and coffee plantations were also present in the sanctuary. Tribal habitats were present in and around the WWLS forest areas.

Most of the study was done in those ranges. Due to the night surveys, anti-poaching camps (APCs) are selected, and those camps were more flexible for night surveys. Because those camps had almost nil anthropogenic disturbances. Breeding time of the owls mostly started the late of October and it extend till April. However, the breeding time showed variations in different species level. But this study was carried out from January to April. The high migration rate of large mammal's especially Asiatic elephants and tigers and encounters with those animals surveys were sometimes discontinued. In addition, the low rainfall rate created a high chance of forest fire (fire season) which also negatively affected the

project implementation. Usually surveys were carried by walk and in some instances, vehicles were used (Tholpetty) because of the high chance of encounter by migratory large mammals.

A total of 34 individual points surveyed all over the WWLS division. The area covered was very less compared to the size of the WWLS area. The major difficulties for a larger cover area were animal migration, forest fire and lack of support from the authorities.

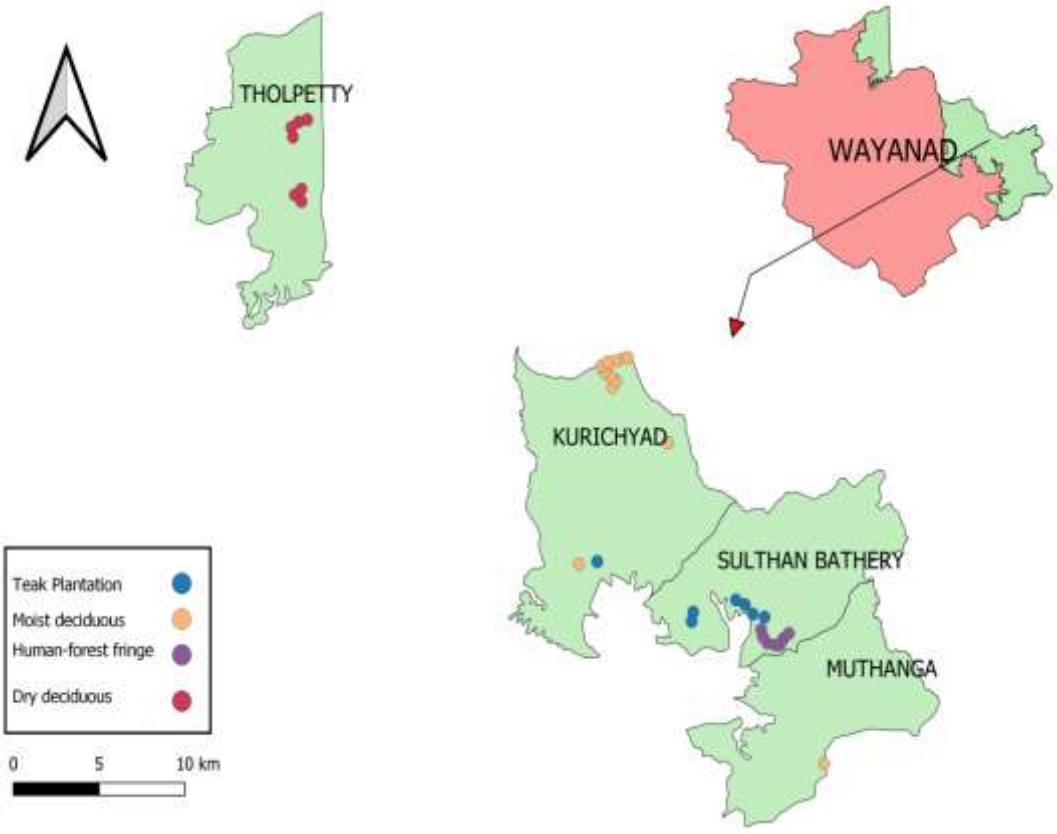

Plate 1: Point surveyed in Wayanad wildlife sanctuary and its different habitat.

3.2 Selected species

Though 12 species were reported in Wayanad district (ebird 2020), for the study a total of eight species were selected. . Those selected eight species were Jungle owlet (*Glaucidium radiatum*), Indian scops owl (*Otus bakkamoena*),

Oriental scops owl (*Otus sunia*), Brown boobook (*Ninox scutulata*), Brown wood owl (*Strix leptogrammica*), Mottled wood owl (*Strix ocellata*), Spot bellied eagle owl (*Bubo nipalensis*) and Brown fish owl (*Bubo zeylonensis*). The reason for selecting those species was easy to distinguish by its call/song. Excluded species were Barn owl (*Tyto alba*), Sri Lankan Bay owl (*Phodilus assimilis*), Indian eagle owl (*Bubo bengalensis*) and Spotted owlet (*Athene brama*). Species like Barn owl, Sri Lankan Bay owl and spotted owlets usually responded by scream. This can't play back effectively. Presence of the Indian eagle owl was almost uncommon or even very rare in Wayanad.

3.3 Study period

Owls' responses to its own conspecific call/song were present throughout the year. But the response peaked at the breeding time. Almost all the selected species breed during October to June (Darmakumarsinhji, 1955; Robert and King, 1986; Mehta *et al.*, 2018; Pande *et al.*, 2018; Samarawickrama *et a.l*, 2006). However, a slight variation in existed for each species' breeding time, but response by call/song won't change. So January to April was selected for the survey.

3.4 Survey methods

3.4.1 Dusk watch

Owls start perching usually after sunset. So there was a chance of encountering those species at that time. So, dusk watches usually started after 5-6 pm or sunset. Line transects method was used to do it. A 1 Km path was selected for the line transect. Documented every bird species sighted in the survey.

3.4.2 Initial quiet listening

A standard period of 5 minute was used to spend at each point by arrival. Documented every unsolicited calls and movements during that time period. A longer period of 10 minutes was used at the beginning of survey period, but it was found that 5 minutes iwa sufficient and flexible after some surveys. At the time of quiet listening, the spotlight method was also done at the same point.

3.4.3 Call play-back

Call play-back method was usually followed after the initial quiet listening. Primarily a standard 30 seconds of call play-back was done by using a Bluetooth speaker (UE roll) at its maximum output sound, followed by 90 seconds of listening period carried by a handy recorder (zoom h4n). All responses of owls were recorded, both call and detection. Call play-back surveys were only conducted during quiet and undisturbed environments, because little wind or rainy noises reduced the effectiveness of these surveys (Kavanagh and Peake, 1993; Debus, 1995). Total eight species of owl calls were broadcasted. It took almost 21 minutes to complete the eight species call play-back method in a single survey point including initial quiet listening and spot lighting method. All the owl calls were collected mostly from online resources like xeno canto and e-bird call records.

3.4.4 Spot lighting

A spot light method employed the torch light for searching any species movement which was documented near by the survey points after ending the call playback call. 2-3 minutes used to spend at each point for the spot lighting method. Only sighting records were taken.

Equipment and Analyzing tools Used

Equipment like light (Mr. light cobra GT:5 torch, Head torch) were essential for surveys like night surveys. And equipment like (UE roll bluetooth speaker, Zoom h4n handy recorder and Smart phone) were essential for method like call play-back as a source of play backing owl calls and as a recorder needed for documenting responses. Smart phone used as a flexible device for giving the input to play backing speaker.

Raven pro was used to analyze the latency response of owls. It also showed the spectrogram of each sound file. Audacity used to cut and amplify the recorded sound files. Further, it reduced the noises of the sound files which were taken from the project fields. Windows excel used to analyze the statistical result from the field data.

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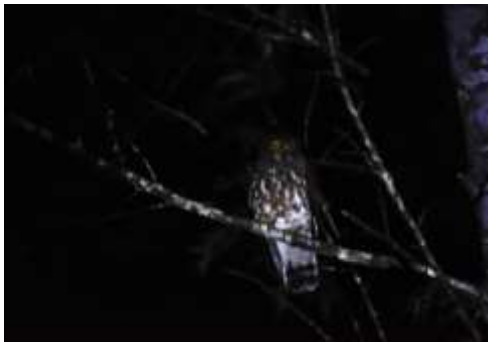



Plate 2: Fig. a.Jungle owlet b. Indian scops owl c. Oriental scops owl d. Brown hawk owl e. Brown wood owl f. Mottled wood owl g. Spot bellied eagle owl h. Brown fish owl

4. RESULT

4.1 SPECIES INVENTORY AND SPECIES RICHNESS

4.1.1 DUSK WATCH

Dusk watch didn't give any important data to the survey. But activities of other than the focused nocturnal species (owls) were documented as a procedure. Only Jungle owlet presence was the only owl which was documented through this method.

4.1.2 QUIET LISTENING

During the quiet listening time, out of the eight species focused, five species were documented. Oriental scops owls were recorded higher times followed by Brown hawk owl, Jungle owlet and Brown fish owl. Mottled wood owl was recorded only once during the entire period. We also recorded spotted owlet (*Athene brama*) which was not included in the focused list.

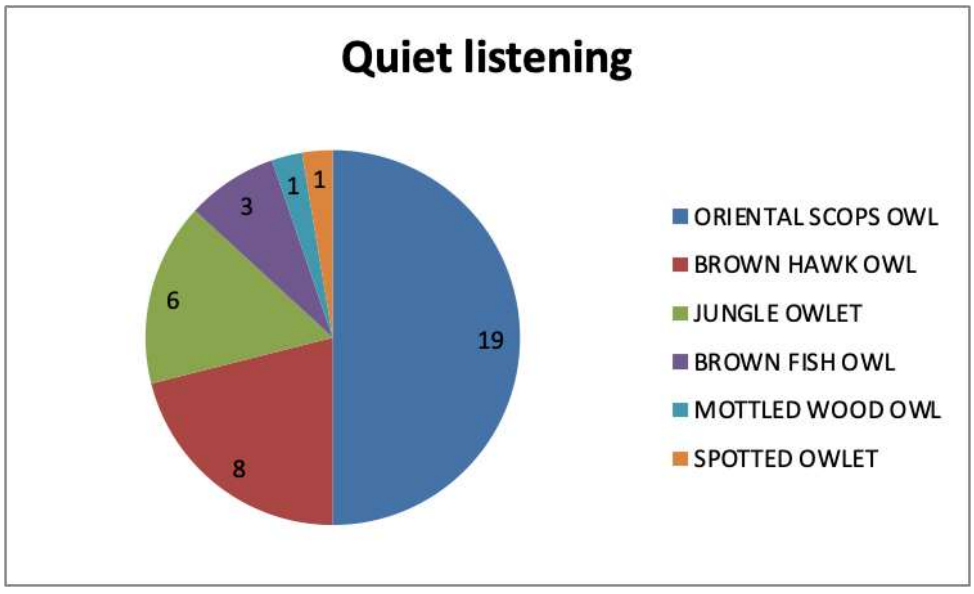

Figure 1: Number of species present in quiet listening method.

4.1.3 CALL PLAY-BACK

Out of eight species call play backed; only five species responded to its own conspecific call playback. Species like Brown fish owl (*Bubo zeylonensis*), Brown wood owl (*Strix leptogrammica*) and Mottled wood owl (*Strix ocellata*) did not respond to their own conspecific call playback.

Oriental scops owl (*Otus sunia*) responded to most of the call playback (62% response) followed by Jungle owlet (*Glaucidium radiatum;* 50%), Brown hawk owl (*Ninox scutulata*; 48%) and Indian scops owl (*Otus bakkamoena*; 14%). Spot bellied eagle owl (*Bubo nipalensis*) responded only once to its conspecific call (2.4%).

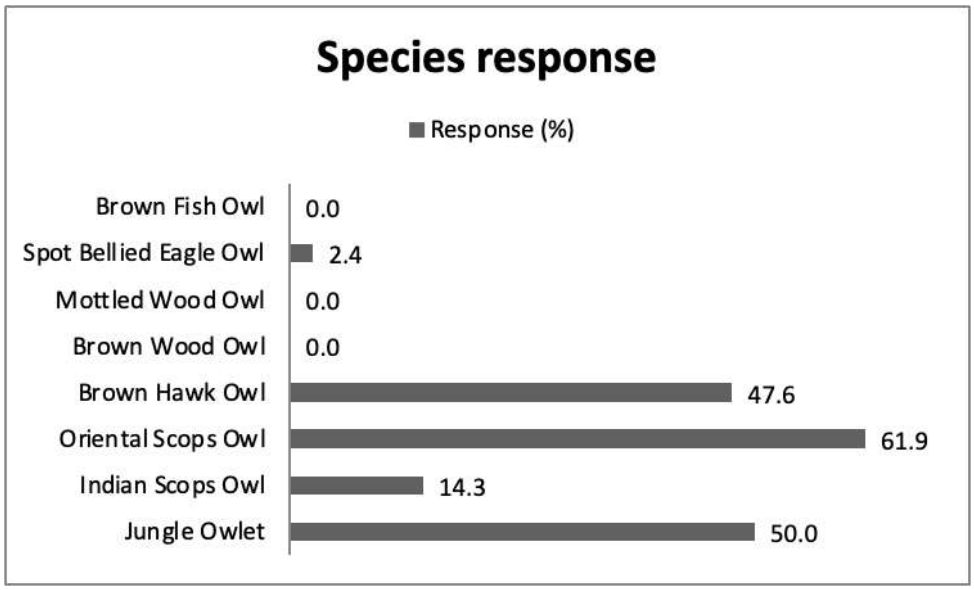

Figure 2: Call playback response of selected owl species.

4.1.4 SPOT LIGHTING

During the spot lighting method, species detection was very less. There was only one incident where a\ Brown fish owl was spotted soon after its call playback.

4.2 CONSPECIFIC CALL RESPONSE

After the data analysis, con-specific call responses of the owls were showing some difference in the species level. Out of the eight species call

playback only five species responded to their conspecific calls. Species like Brown fish owl, Brown wood owl and Mottled wood owl not responded to their conspecific calls, making them 100% absent for conspecific call response throughout the survey time period.

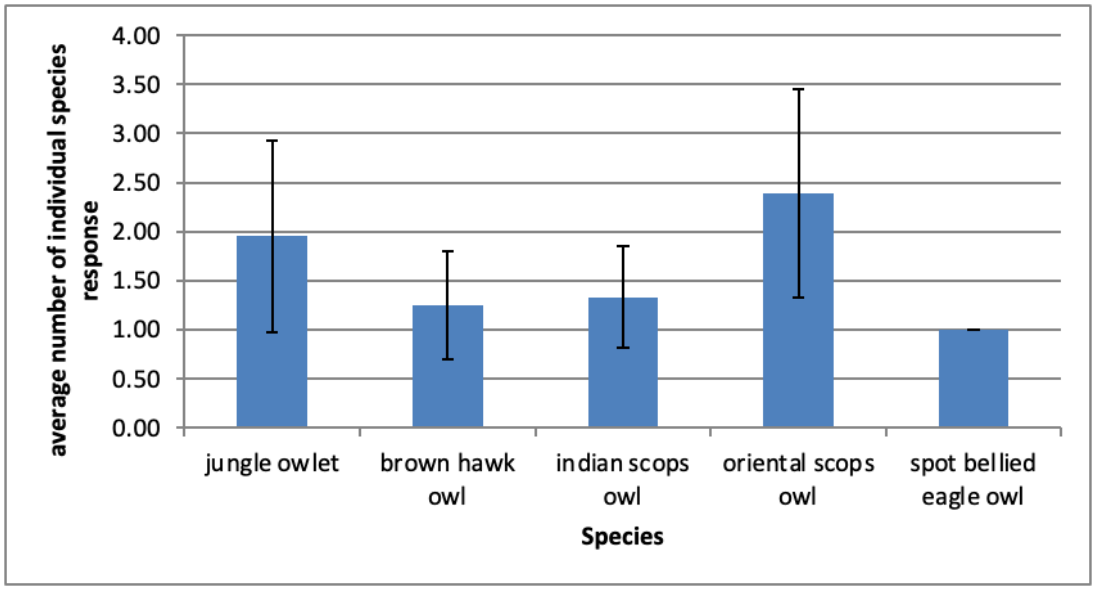

Figure 3: Average number of individual species response obtain from call playback method.

Average number of individual species responses (n) varied among species (Fig. 4). An average number of individual response (n) 2.38 ± 1.08 of Oriental scops owl responded to the call playback. While the average number of individual response by Jungle owlets was 1.95 ± 0.97 and Brown hawk owl 1.25 ± 0.55 respectively.

Call playback latency of species was different. Oriental scops owl had a quick response during call playback (14.08 ± 19.48 sec), followed by Brown hawk owl (25.90 ± 26.17 sec), Jungle owlet (31.76 ± 26.85 sec) and Indian scops owl (36.83 ± 24.8 sec) respectively. While the single response recorded for the Spot bellied eagle owl was 86 seconds.

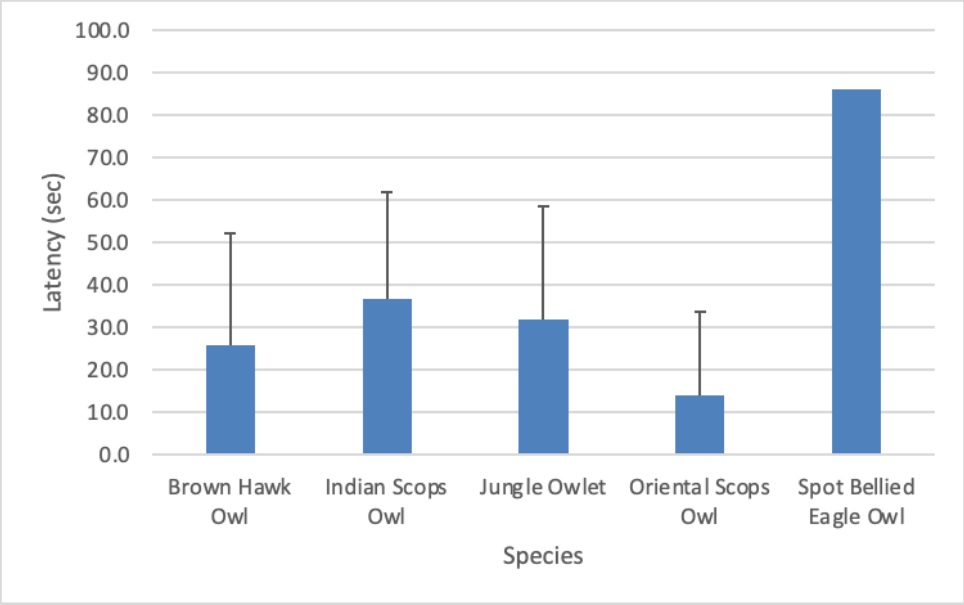

Figure 4: Latency of con specific call response.

4.3 INTER-SPECIES RESPONSE

Some species responded to almost all species call play-back. Species like Jungle owlet, Oriental scops owl and Brown hawk owl were the major shareholders in this scenario.

PLAY BACKED SPECIES	Brown Fish Owl	Brown Hawk Owl	Brown Wood Owl	Indian Scops Owl	Jungle Owlet	Mottled wood owl	Oriental Scops Owl	Spot Bellied Eagle Owl
Brown Fish Owl	0	12	1	2	4	0	18	1
Brown Hawk Owl	2	20	0	8	6	0	26	1
Brown Wood Owl	2	22	0	5	4	0	19	0
Indian Scops Owl	1	5	0	6	11	0	18	0
Jungle Owlet	0	5	0	0	21	0	12	0
Mottled Wood Owl	1	21	0	4	2	0	17	0
Oriental Scops Owl	1	4	0	6	6	0	26	0
Spot Bellied Eagle Owl	0	14	0	2	2	0	19	1

Table 1: Inter species interaction of owls surveyed.

Jungle owlet

Jungle owlet, Oriental scops owl and Brown hawk owl responded to every call playback (Table 1) while Indian scops owl responded to every calls except that of Jungle owlet

During the study, when Jungle owlet call was played, Oriental scops owl (n=12) and Brown hawk owl (n=5) were responded.

Indian scops owl

When an Indian scops owl (*Otus bakkamoena*) call was played, a higher chance of response were noted. The Oriental scops owl (n=18) followed by Jungle owlet (n=11), Indian scops owl (n=6), Brown hawk owl (n=5) and Brown fish owl (n=1) were responded to Indian scops owl play-back.

Oriental scops owl

Oriental scops owl (*Otus sunia*) was one of the most annoying and most responded (n = 26) species. Species like Jungle owlet (n = 6), Indian scops owl (n = 6), Brown hawk owl (n = 4) were one of the ceaseless responders. In addition, Brown fish owl (n = 1) also responded to Oriental scops owl call play-back.

Brown hawk owl

Brown hawk owl was one of the most responded (n = 20) species for call playback. Species like Jungle owlet (n = 6), Oriental scops owl (n = 26), Indian scops owl (n = 8), Spot bellied eagle owl (n = 1) and Brown fish owl (n = 2) were responded to its paly back.

Brown wood owl and **Mottled wood owl**

Brown wood owl (*Strix leptogrammica*) and the Mottled wood owl (*Strix ocellata*) were almost unavailable for their conspecific calls. Species like Brown hawk owl (n=22 & n=21) and Oriental scops owl (n=19 & n=17) were the most responding species followed by Jungle owlet (n=4 & n=2) and Indian scops owl

(n=5& n=4) when the Brown wood owl and Mottled wood owl calls were play-backed respectively. Some instances, Brown fish owls (n= 2 & n=1) also responded to the both wood owls call when play-backed.

Spot bellied eagle owl

One of the large owls, Spot bellied eagle owl (*Bubo nipalensis*), was very less responsive to its conspecific call (n = 1). Species like Oriental scops owl (n = 19), Brown hawk owl (n = 14), Jungle owlet (n = 2) and Indian scops owl (n = 2) were responded when Spot bellied eagle owl call was played.

Brown fish owl

Brown fish owl (*Bubo zeylonensis*) did not respond to its own conspecific call play-back. Whereas species like Oriental scops owl (n =18) and Brown hawk owl (n = 12) hold high response and followed by Jungle owlet (n = 4) and Indian scops owl (n = 2) respectively. Other than those, responses of Brown wood owl (n = 1) and Spot bellied eagle owl (n = 1) were also documented.

4.4 HABITAT- SPECIES RESPONSE

Only four habitats were surveyed (Fig 6), species like Brown wood owl and Mottled wood were almost absent in all habitats when the survey was conducted. Only once Brown wood owl had been reported in the moist deciduous habitat. Large species like Spot bellied eagle owl were reported mainly in the moist deciduous habitat. Medium species owls like Brown hawk owl was recorded in all the habitats surveyed but the density was high seen in forest fringes.

They were recorded in almost all habitats surveyed. But mostly present in the forest fringe and followed by moist deciduous, teak plantation and finally the dry deciduous habitat. Smaller species of owls like Jungle owlet, Indian scops owl and Oriental scops owl were recorded in all habitats except forest fringe.

Jungle owlet and Indian Scops owl were mostly recorded in the teak plantations followed by the dry deciduous and moist deciduous habitats. But Oriental scops owl were found mostly in the dry deciduous habitat and followed by moist deciduous habitat.

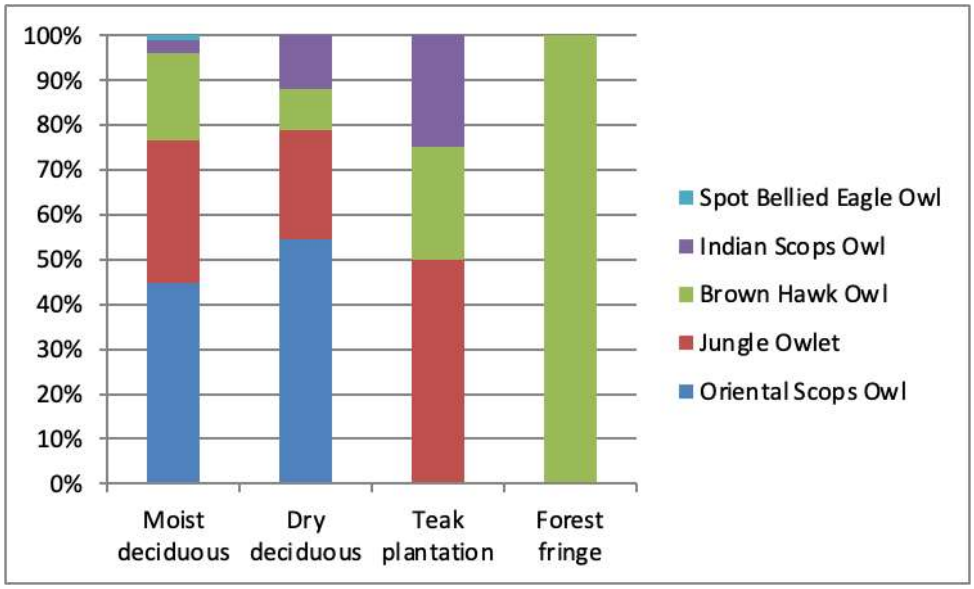

Figure 5: habitat species response.

5. DISCUSSION

Owls are one of the secretive, nocturnal species which is less studied (Takats *et al.,* 2001). Call play-back method for owls sampling is one of the most effective, less time consuming and almost accurate for some owl species (Kavanagh and Peake, 1993; Debus, 1995, Zuberogoitia and Campos, 1998; Martinez and Zuberogoitia, 2002). Moreover, some species, like Eagle owl were not (Martinez and Zuberogoitia 2002) recorded by this method. In this survey, unresponsive species were Brown fish owl, Brown wood owl and Mottled wood owl. Some factors such as wind speed and rainfall adversely affected the effectiveness of the call play-back method as reported by Morrell *et al.* (1991); Kavanagh and Peake (1993) and Debus (1995).

Out of the eight species which call play-backed, only five species responded to their con-specific calls. Species like Brown wood owl, Mottled wood owl and Brown fish owl were not documented for their own con-specific calls. This is may be accounted to broadcasting calls efficiency, because those species produce mostly sound like hooting or low pitched notes which can't be effectively playback. Another rare chance contributed by the rarity of the species. Species such as Brown fish owl, Mottled wood owl (Marks *et al.,* 1999) and Brown wood owl were considered as uncommon and also (Jayson and Sivaram, 2009). Those factors supported our recorded findings wherein only five species ply backed. Further, one species (Spot Bellied Eagle Owl) documented only once to its con-specific call in the whole survey period.

During the survey period, other than the selected species, one pair of Spotted owlet were recorded during the quiet listening period. During the dusk-watch method, only one individual count (Jungle owlet) was recorded, while the quiet listening method recorded 37 individuals (Jungle owlet 6, Oriental scops owl 19, Brown hawk owl 8, Mottled wood owl 1 and Brown fish owl 3 and one Spotted owlet). In the spot lighting method, only one individual Brown wood owl was documented. This shows the importance of the call playback method for

surveying nocturnal birds like owls to get more effective data as suggested by Hannah (2009) and Zuberogoitia *et al.* (2011).

From the dusk watch, species encounter was very less. The earlier published records suggested the activity of the owls starts almost after the dusk. But, during the survey species like Jungle owlets were observed inactive during the night time. But in many instances, the birds were spotted in the afternoon (1pm to 6 pm). The findings suggest that activity of some species (nocturnal or diurnal) extends into crepuscular hours as suggested by Jaksic (1982).

A total of 42 times call play backed each species, Jungle owlet responded only 21 times, and almost 41 individual call responses were recorded. In the case of Indian scops owl, only six responses and eight individual species responses were recorded. Oriental scops owl were one of the most highly responded species, around 26 times. Further, 62 individual species responses were also documented. Brown hawk owl in that scenario responded to its con-specific call only 20 times and around 25 individual responses were documented. Spot bellied eagle owl responded only once to its con-specific call with a single individual count which indicates that spot bellied owls are rare in Wayanad wildlife sanctuary area.

Considering the whole call playback surveys, inter or intra species call responses came mostly from the lesser species of owl (Jungle owlet, Oriental scops owl, Indian scops owl and Brown hawk owl). This is mainly due to the territorial defense mechanism, breeding time response as prposed by Jayson and Sivaram (2009). Larger species like Brown fish owl, Spot bellied eagle owl, Mottled wood owl and Brown wood owls were not showing much response to either interspecific or intraspecific call playback.

The most responded species of owls for their con-specific calls in the whole survey period and the number of individual response (n) mentioned in brackets in the decreasing order were of Oriental scops owl (2.38±1.06), Jungle owlet (1.95±0.97) and Brown hawk owl (1.25±0.55). The said data indicated that when a con-specific call was played, the response from those species may consist

of one or more individuals, especially in the case of Oriental scops owl, usually minimum of two individual responses were obtained. Species like Oriental scops owl and Brown hawk owl were almost detected in all call play-back species response lists. Brown hawk owl was one of the most noticeable responding species owls in the Wayanad wildlife sanctuary and was in concurrence with the reports of Sai, (2020). Further the data suggested that, the most counted species response came from these two ones (oriental scops owl and Brown hawk owl). Moreover, after the triggering by con-specific call playback those two species were observed not silent even after the whole survey ended. This difference in the call response to the call playback can be related to the species abundance in the study area as proposed by Enríquez and Salazar (1997). During the survey period, absence of species like Brown wood owl, Mottled wood owl and Brown fish owl response to con-specific call playback needed more justification. The reason for non-responsiveness to con-specific call/ broadcasting calls may be the con-specific call/ broadcasting calls is not effective when there is a chance of floaters. Floaters indicate sense of dispersing young ones or adult ones which are looking for territories. Another factor is attributed to if paired owners/partners co-exist with each other in a territory, they will not respond to the con-specific call playback as evidenced by Rohner (1997). The direct sightings were only limited to species like Jungle owlet, Brown hawk owl and Brown wood owl in the whole survey period. In the scenario, only the Brown hawk owl was directly encountered when approaching into the broadcasting source (speaker). Small species like Oriental scops owl and Indian scops owl were encountered high in playback response, but not in direct sighting. Other than the Jungle owlet, it was my first time sighting of a Brown hawk owl and Brown wood owl.

The call response latency indicated that a quick response or response while broadcasting can expect from species such as Oriental scops owl (14.08 ± 19.48 sec), Brown hawk owl (25.90 ± 26.17 sec) and Jungle owlet (31.76 ± 26.85 sec). In that entire instance, it took below 30 sec for responding when their con-specific call was played.

Species like Jungle owlet were almost silent until the playback started, when the broadcasting started, a gaped response was noticed from the Jungle owlet. But a quick response always perceived and epected if the species were nearby in the play-backing source. However, the Oriental scops owl and Brown hawk owl species were active in almost all the night surveyed because the birds gave a quick response within 0-4 seconds, The most quick response gained from the species wise con-specific call playback was from Oriental scops owl (50% from 26 times response) followed by Jungle owlet (23.8% from 21 time response) and Brown hawk owl (20% from 20 time response).

Inter-species response was very interesting. The most species responses (6 species) were documented when the Brown fish owl broadcasting call was played, wherein Brown fish owl was completely absent. In that scenario, presence of Brown wood owl response and Spot bellied eagle owl response were not expected and Brown wood owl response was reported only once in the entire survey period. Small owl species like Jungle owlet, Indian scops owl and Oriental scops owl gave responses to the Brown fish owl broad casting call.

Small or medium size owls (Jungle owlet, Indian scops owl, Oriental scops owl and Brown hawk owl) were almost found in the entire forest habitat surveyed. A higher chance of occurrence of Oriental scops owl was in the dry deciduous habitat (58%) while Indian scops owl (30%) and the Jungle owlet (30%) were found high in the teak abundant habitats. The data indicated the habitat preference of those species mainly due to foraging, high canopy for prolonging and defending territories as proposed by Ishtiaq (2000) and Jayson and Sivaram (2009). The Brown hawk owl density was also higher in the forest fringe area (100%) during the survey period. Spot bellied eagle owls were found only in the moist deciduous habitat. Spot bellied eagle owl were mostly found in the dense evergreen forest to moist deciduous forest and subtropical coniferous forests, dry riverine forest and was in concurrence with the reports of Srinivasan (2013) and Sharma *et al.* (2020).

From the various methods employed in the survey only the broadcasting method gave the higher chance of encounter/detection for the focusing species and our observation was in agreeable with the findings of Sara and Zanca (1989) Ward *et al.* (1991) and Haugh and Didiuk (1993). But some species such as Mottled wood owl, Brown wood owl and Brown fish owl didn't respond. In such cases, methods like quiet listening and spot lighting were found useful. In the survey, Mottled wood owl presence was recorded during the quiet listening time, though no response occurred in the broadcasting call time. Further, owls were reported very quiet/silent when they fly (Graham 1934) which also reduce the chance of encounter. In such occasions, spot lighting during the survey time provided some additional data..

During the survey time, a large brown flying squirrel (*Petaurista philippensis*) response was also observed for almost all species broadcasting calls. Such a behavior of the species could be a vigilant mechanism of the bird or may be a reaction to avoid predatory act by a large brown flying squirrel to owl broadcasting call as stated by Babu and Jayson (2009).

Limitations

Owl census is considered as a time consuming one (Duncan & Duncan 1997). When the number of focusing species is increased, survey consume more time in the field, because each species needs at least 3-5 minute call playback and responding time period. Further additional time is required for the quiet listening and spot light method. So the entire survey almost took 21 minutes for completion on eight species in a single survey point. Further, a minimum of 3-5 people are needed for the survey, because equipment handling (one should handle broadcasting source, one for recording response, one for watching the surroundings) is not an easy task. In addition, during the night survey, animal encounters could also be expected which necessitates one or two forest watchers/ experts a in the team.

Moreover, environmental factors like wind and rain affect the both response and call play backing efficiency of surveying of nocturnal birds like owls. (Olsen *et al.,* 2002). Rain can cause poor hearing owl vocalization (Morrell *et al.,* 1991). In addition to this, disturbance like insect noise, high sensitivity and lack of handling of recorder which is used, time of surveying, disturbance produced during survey (sound produced by survey team) etc. are also factors affecting the survey. Strategies that can be adopted to optimize these kinds of drawbacks include using windscreens for recorder which will reduce noise and minimizing handling of recorder by using mount during survey to get good quality records. Usually night surveys are more menacing especially in the Wildlife sanctuaries and other protected or not forest areas. At the time of the survey period, direct encounters of tiger (two times), Elephant, and Gaur also occurred.

6.SUMMARY

Owls are the nocturnal birds of prey found across the globe except Antarctica and Green islands. Owls are one of the least studied avian species because of their secretive nature. Owls are easily identified by their calls. They use their calls and songs for attracting mates, and also defend their territory. Among owls, diurnal ones are far less vocal than the nocturnal ones, because they have more vision than the nocturnal ones. Study based on sound is more critical in the case of birds like nocturnal and secretive in nature. Further, every sound they produce were species specific and unique. So methods like acoustics are frequently used for surveying secretive species like owls. Moreover, it's more accurate because each species had unique calls with which species can easily differentiate. So call play-back method is employed as one of the very efficient methods used to detect nocturnal species like owls. From the project, investigation of the selected species of owl's abundance and richness and their habitat preference was done. The most abundant species of owl present in Wayanad wildlife sanctuary was the Oriental scops owl (*Otus sunia*), followed by Jungle owlet (*Glaucidium radiatum*) and Brown hawk owl (*Ninox scutulata).* Out of the eight species call playback, only five species responded to its conspecific calls (Jungle owlet, Indian scops owl, Oriental scops owl, Brown hawk owl and Spot bellied eagle owl). Species like Brown wood owl, Mottled wood owl and Brown fish owl did not respond to its conspecific calls. Among the conspecific calls responded species, the latency of response were very less in Oriental scops owl species followed by Brown hawk owl and Jungle owlet respectively. The habitat preferences of the focused species were sorted in the moist deciduous forest habitat wherein all the five species were recorded in the descending order of species count was, Oriental scops owl, Jungle owlet, Brown hawk owl, Indian scops owl and Spot bellied eagle. Whereas in the dry deciduous forest habitat, species density in the decreasing order was Oriental scops owl, Jungle owlet, Indian scops owl and Brown hawk owl. In the teak abundant plantation habitat, species diversity variation exhibited a declining trend in the order Jungle owlet, Indian scops owl, and Brown hawk owl. The density of Indian scops owl and

Brown hawk owl was almost equal. Other than these, the forest fringe habitat is absolutist by only by the Brown hawk owl at the survey period.

In the survey, all the focusing species were found when a combination of all the methods was used. In addition, some are uninvited unfocussed species were also Spotted owlet observed. Further, the survey also points to the significance of the call playback survey for investigating nocturnal species especially owls. The species encounter rate is very high when the call playback method is used, in comparison to the other methods.

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8. ABSTRACT

Owls are one of the least studying avian species because of their secretive nature. The distribution of owls was studied in Wayanad Wildlife Sanctuary (WWLS) using call playback method. Out of eight species focused by call playback; only five species responded to its conspecific call play back. Oriental scops owl (*Otus sunia*) responded to most of the call playback (62% response) followed by Jungle owlet (*Glaucidium radiatum;* 50%), Brown hawk owl (*Ninox scutulata*; 48%) and Indian scops owl (*Otus bakkamoena*; 14%). Spot bellied eagle owl (*Bubo nipalensis*) responded only once to its conspecific call (2.4%). On an average, the number of individual responses (n) of Oriental scops owl responded to the call playback was 2.38 ± 1.08. While the average number of individual response by Jungle owlets was 1.95± 0.97 and Brown hawk owl 1.25± 0.55 respectively. A higher chance of occurrence of Oriental scops owl was found in the dry deciduous habitat (58%) while Indian scops owl (30%) and the Jungle owlet (30%) were found high in the teak abundant habitats. Whereas species like Brown hawk owl was found higher in the forest fringe area. Spot bellied eagle owls were found only in the moist deciduous habitat when the survey was done. The study showed the importance of how the call playback method plays the role to investigate secretive, nocturnal species like owls.

KERALA VETERINARY AND ANIMAL SCIENCES UNIVERSITY

Faculty of College of Veterinary and Animal Sciences

PROGRAMME OF RESEARCH WORK FOR DISSERTATION FOR MASTERS DEGREE

(Vide Rule 25(b) of Post Graduate Regulations 1998)

1. Title of Work

Investigate selected strigiformes; evaluate their con-specific call response, interspecies response and habitat preference in Wayanad wildlife sanctuary, Kerala

2. a. Name of the student

ASWIN SAI K .V.

b. Admission No

18-MSVP-07

3. Objectives of the study

5. Investigate the selected Strigiformes presence in the Wayanad Wildlife Sanctuary
6. Con-specific call response of owls in the Wayanad Wildlife sanctuary
7. Interspecies response of owls using call playback method in Wayanad Wildlife sanctuary
8. Evaluate habitat preference of owls in Wayanad Wildlife sanctuary

4. Practical and scientific utility

Owls are worldwide order of birds known as Strigiformes have 216 species varying from the size of the tiny; sparrow sized Elf Owl to the Indian eagle owl which has a wing span of two meters and weigh up to 5 kg. They are separated into two families, the first is the tytonidae which include 17 species and the rest of the 198 species include the family strigidae.

There are 244 species of owls present all over the world out of which 33 species have been reported in India. Most of them are concentrated in north east region of the country (ENVIS 2007). Only 16 species of owls are reported in Kerala (Easa and Jayson, 2004). Among these 16 species, three are migratory and the other 13 are resident.

Owls are nocturnal avian predators, which possess large home

range and occupy complex habitats for breeding, roosting and foraging. They are a group of predatory birds, characterized by upright posture and large forward facing eyes surrounded by a disk of short stiff feathers. These birds occupy the equivalent niche as the diurnal birds of prey such hawks, falcon, eagles and buzzards, though they are not related. Data on owls data is scarce mainly because they are nocturnal top predators with large home range and complex habitat requirements. A landscape approach is necessary for modeling distribution of owls and conserving habitats for them. Owls need tree hollows for nesting and some species need them for roosting. The collective noun of owls is 'parliament'(Jayson, 2007).

Information available on strigiformes, is scanty in Wayanad. Other than the general list of raptor species presence limited to Wayanad Wildlife Sanctuary area, no information is available on their ecology and diet in the Wayand Forest Divisions. This information is essential for revising the conservation status of these elusive species. Under these circumstances this study is proposed and design in species inventory, habitat preference and diet composition of selected Owl species in Wayanad Wildlife Division.

5. Important publications on which the study is based.

Jayson *et al*. (2009) published a checklist of Western Ghats forest owls along with behavioural, ecological and habitat model developed for the conservation of owls in their area of study. The authors reported 16 species of owls present in the Western Ghat region within Kerala and Tamilnadu states alone.

Hayward and Garton (1988) suggested that factors like difference in food, activity time, environmental factors and morphological difference between species and also the recent interspecific competitions shaped the habitat use of owls in Idaho, U.S.

Kavanagh & Peake (1993) stated that the effectiveness of the call play-back method depends on

some variables like wind and rain. Call play-back surveys were effective when there is no/less wind or no rain nights.

Debus (1995) stated that call play-back methods can be used as a high detection method for owl surveys. And also he said that windy and rainy nights can't give accurate data because of the noise which affects the owl detection.

6. Outline of the technical programme

Study area

Wayanad Wildlife Sanctuary (WWLS) is situated in the Western Ghats region and shared its boundary with Bandipur National Park and Mudumalai Tiger Reserve. WWLS is very popular for its flora and fauna.

The sanctuary was divided into four ranges namely Muthanga, Bathery, Kurichiyath, and Tholpetty. Anti-Poaching camps in these ranges should select for the survey.

Species inventory survey

The entire study area will be divided into 4 sq/km grids. Survey will be carried out in the selected grids. Point count method will be used to get the abundance and species of owls in each randomly selected grid. Species will be documented using call playback method and initial quiet listening method which was found efficient in a previous study (Jayson and Sivaram, 2009). In initial quite listening method, a standard period of 10 minutes will spent on arrival at each site, record it and watching and listening quietly for unsolicited calls or movements of owls in adjacent forest. Subsequently, call playback surveys will be conducted during calm nights with little or no rain, as wind and rain noise reduce the effectiveness of this survey method (Kavanagh and Peake, 1993; Debus, 1995). The sequence of call will be played as such to give maximum time for owls to respond to their own calls, as delayed responses are common. Owl call recordings of different species from earlier recordings and also used BNHS and Xento Canto will be used for the study.

7. Main items of observations to be made

- Selected owl species composition in the Wayanad Wildlife Sanctuary
- Photo/sound recording for species identification

8. Facilities

a. **Existing:** All facilities available at KVASU/Centre for Wildlife Studies will be utilized for the study.

b. **Additional facilities required:** Call play back recorder, accessories, tracker, etc

9. **Duration of study**: One Semester

10. **Financial estimate**

Total :15000

11. Signature of student

12. Signature of Major Advisor

Place:

Date:

13. Name, designation and signature of Member of the Advisory Committee

1. **Dr. Rajini C.V.**
   Assistant professor
   Department of veterinary anatomy and histology.
   College of Veterinary and Animal Sciences, Pookode.

2. **Dr. Patki Harshad Sudhir (member)**
   Assistant professor
   Department of veterinary anatomy and histology.
   College of Veterinary and Animal Sciences, Pookode.

3. **Dr. George Chandy (Course Director)**
   Special Officer,
   Centre for Wildlife Studies,
   College of Veterinary and Animal Sciences,Pookode.

APPENDIX I

Reference

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APPENDIX.II

Time frame of work

Semester IV

Field observations

1. Lab work for Analysis of component in the pellets
2. Data collection and analysis
3. Interpretation of result
4. Dissertation writing

CERTIFICATE

Certified that the research project has been formulated observing the stipulations laid down under the Prevention of Cruelty to Animals Act (Amendment, 1998)

Place : Dr. Rajini C.V.

Date : Major Guide

CURRICULUM VITAE

Name of the candidate	**Aswin Sai K V**
Date of Birth	**05/12/1997**
Place of Birth	**Sulthan Bathery**
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Major Field of Specialization	**Wildlife Studies**
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Professional Experience	**Nil**
Publications made	Sai. A (2020) A duet with brown boobook (Ninox scutulata) in Wayanad Wildlife Sanctuary, Kerala. *Newsletters for birdwatchers*. 60(1): 7-8.
Membership in Professional bodies	**Nil**