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Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2019; 7(5): 194-198

Received: 04-07-2019
Accepted: 06-08-2019

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Seasonal distribution of Sri Lanka bush warbler (*Elaphrornis palliseri*) in the Horton plains national park

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Abstract
Seasonal distribution of *E. palliseri* was investigated from January to November 2017 at the Horton Plains National Park (HPNP). In CF, three 50m additional transects were placed to cover three different forest areas as deep forest, forest middle and forest edge and surveyed using visual encounter method during morning, midday and evening time periods in each habitat for three consecutive days in each month. Abundance of Bush warblers within 10m distance from each transect were recorded in all four climate seasons in the HPNP. Three 100m line transects were placed randomly in the three major habitats of HPNP identified as Cloud forest(CF), Cloud forest die back(DB) and Grassland(GL). *E. palliseri* were only encountered within CF and DB habitats. Their abundance did not differ significantly among the four climate seasons (Kruskal- Wallis Test, $p>0.05$). Highest abundance was recorded in the First Inter Monsoon Season (15.5±4.95). SIMS was identified as the season with harshest environment conditions at HPNP in 2017. *E. palliseri* was not encountered within DB and CF middle during SIMS. In SIMS, lowest T (15.58±0.55 °C), highest RH (99.4±0.32%), highest WS (15.25±5.71Km/h) and highest RF (221.8±32.81mm) were recorded. A positive correlation was obtained in between average T variation and abundance (Pearson Correlation (r) =0.995, $p<0.05$). Negative correlation between average RH and abundance (r = -0.919, $p>0.05$), between average WS and abundance (r = -0.854, $p>0.05$) and also average RF and abundance (r = -0.520, $p>0.05$) were acquired. Further research should be conducted to determine how they react to harsh climatic conditions and whether they perform local migration with respect to the unfavorable conditions. Finding of the present study warrant further studies with regard to *E. palliseri* for their conservation.

Keywords: Seasonal distribution, *E. palliseri*, horton plains national park, cloud forests, grasslands

1. Introduction
Sri Lanka is a tropical island in the Indian Ocean located between latitudes 5° 55´- 9º 51´ N and longitudes 79º 41´- 81º 53´ E. It has a maximum north-south length of about 435 km and an east-west width of about 225 km [1]. The island is divided into three major climatic zones based on the geographic position and the topography. Moreover, the habitat characteristics in the country vary widely supporting the large biodiversity [1].

Rain fall of Sri Lanka is largely governed by monsoonal winds which occur during two seasons of the year. From Mid-May to September, the monsoon blows from the southwest direction and brings in a greater amount of moisture than during December to February when the wind blows from the northeast. The distinct inter-monsoonal periods receive conventional rains and at times cyclones [2]. The climate experienced during 12 months period in Sri Lanka can be characterized into four climate seasons as, First inter monsoon season – FIMS (March-April), South West monsoon season - SWMS (May-September), Second inter monsoon season - SIMS (October- November), North East monsoon season - NEMS (December-February) (source: http://www. meteo.gov.lk). Besides rainfall, temperature plays an important role in highland regions. For every 100m increase in elevation, the mean temperature falls by 0.5 ^{0}C [2].

The Sri Lanka Bush Warbler, *Elaphrornis palliseri* [3] is an endemic bird species to Sri Lanka [7]. It is considered as a near threatened bird species [4] due to its restricted range [5]. *E. palliseri* belongs to Order Passeriformes, family Locustellidae/ Silviidae and called as *Kandu hambu Kurulla* or *Wanaravia* in Sinhala language. This species confined to elevations above 3,000 feet and it prefers habitats with dense undergrowth of mountain forests, or thick shrubs. It occasionally ventures into tea-fields situated adjacent to forest areas. This is one of the major

bird species which was frequently recorded in most of the birds' studies conducted in montane regions of Sri Lanka [6, 7, 8]. In Sri Lanka, the genus *Elaphrornis* is considered as a monotypic genus which contains only one resident species, *E. palliseri*.

E. palliseri is slightly larger in size than a house sparrow and is ash in colour. Sexes are alike, except that the male has red irides while that of females are pale buff (Figure 1). It seldom ascends more than a yard or two above ground level [9, 10]. It is considered as an insectivore's bird which prefers soft bodied green crickets (Family *Tettigoniidae*) that hides the underside of leaves [9, 10]. It can be occasionally observed as pairs, along with the mixed–species flocks in Horton Plains National Park and is also known as a territorial bird [6]. Its' breeding season takes place from February to May, with a secondary season in September. Although much of its habitats remains secure, the declining of its population can be attributed to the habitat loss in some areas, and this situations should be carefully monitored [5].

Fig 1: Male (right) Sri Lanka Bush Warbler and the female (left) Sri Lanka Bush Warbler.

2. Materials and Methods

The study was conducted in Horton Plains National Park, for three consecutive days per month from January to November 2017. Three main habitats were selected as Cloud forest habitat, Cloud Forest Die Back habitat and Grassland habitat. In each habitat three 100m fixed length transects were randomly placed and marked using Global Positioning System (Garmin Etrex euro handheld GPS receiver). Moreover, three 100m transects were placed in three different forest areas in the cloud forest habitats which were deep forest, forest middle and forest edge. Abundance of bush warblers (seen or heard) within 10m distance from each transect/trail (10m from both sides of transects) were recorded while travelling slowly along these transects. Birds were observed using 10 × 50 Nikon binocular.

Transects were surveyed from 0600h to 1830h in three time periods in each day, from 0600h to 1000h (Morning), 1030h to 1430h (Midday) and 1430h to 1830h (Evening). Ambient temperature at chest height, relative humidity and wind speed (using Kestrel 4000 pocket weather meter) were recorded from starting point, midpoint and endpoint of each transect. Monthly rain fall data for the region during the study period was obtained from the Department of Meteorology, Colombo, Sri Lanka. Acquired data were segregated according to the four climatic seasons.

2.1 Data analysis

"Minitab version 16" statistical software package and Microsoft excel 2007 were used for statistical analysis and graphical representation of results. Sample data were checked for normality and other assumptions of parametric tests when required and correlation was obtained. Kruskal-Wallis Test was used to determine the significance of the relative abundance in four climate seasons and to determine the habitat selection in four climate seasons. Pearson correlation was used to determine the correlation of the habitat variables and habitat characteristics.

3. Results

Total of 105, *E. palliseri* were recorded at the HPNP during the study period, highest abundance was recorded in February (Figure 2). Out of them 67 were recorded in the Cloud Forest habitat, 38 were recorded in the Cloud Forest Die Back habitat and No *E. palliseri* were recorded in the Grassland habitat during the period. In cloud forest, forest edge recorded the 44 bush warblers, 13 from forest middle and in deep forest 10 bush warblers were recorded. Recorded abundance was not significantly different among four climate seasons (Kruskal-Wallis Test, $p > 0.05$). Average number of individuals in First Inter Monsoon season (FIMS) was 15.5 ± 4.95 whereas in Second Inter Monsoon Season (SIMS) 4 ± 4.24 was recorded. In South West Monsoon Season (SWMS) it was 8.2 ± 6.91 and in North East Monsoon Season (NEMS) recorded 12.5 ± 13.45 average number of individuals throughout the study period (Figure 3).

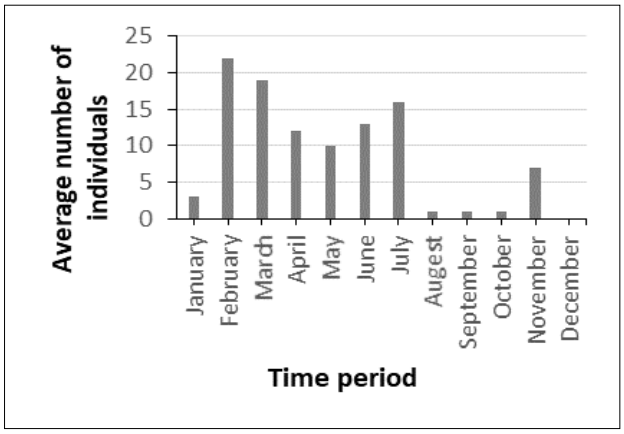

Fig 2: Monthly variation of recorded average number of individuals

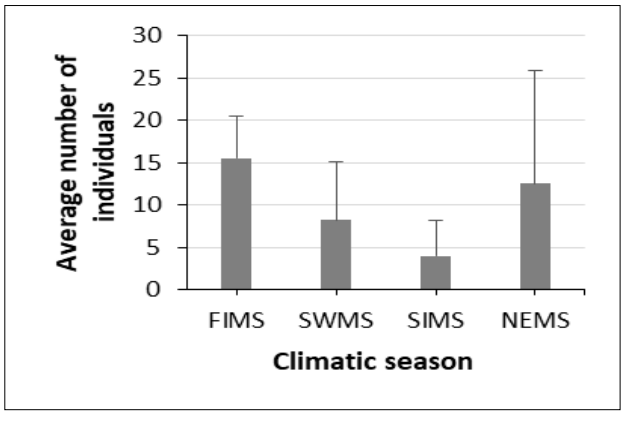

Fig 3: Average number of individuals recorded during the four seasons

Average number of individuals recorded in cloud forest and dieback habitats during four seasons is not statistically significant (Kruskal-Wallis Test, $p > 0.05$) but in SIMS *E. palliseri* not recorded from dieback (Figure 4). In cloud forest *E. palliseri* mostly recorded from cloud forest edges as also in SIMS *E. palliseri* only encountered within forest edge and deep forest (Figure 5).

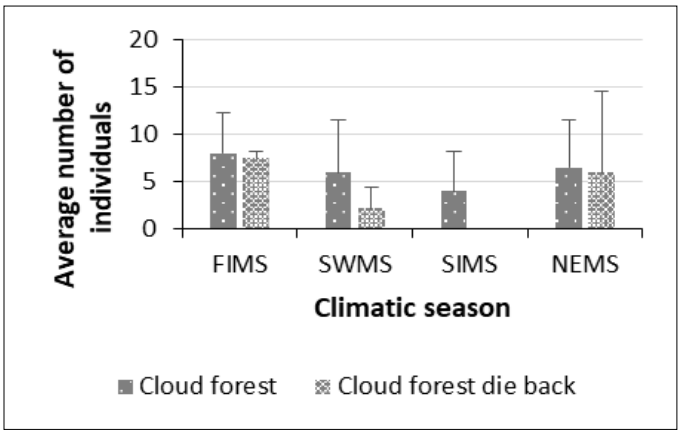

Fig 4: Average number of *E. palliseri* recorded in four seasons in cloud forest and dieback

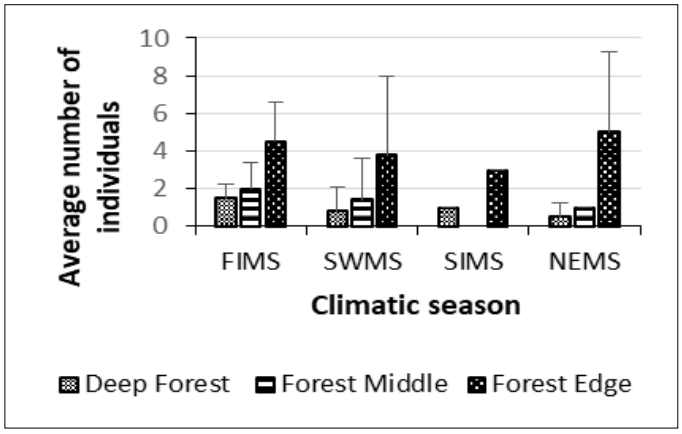

Fig 5: Abundance of *E. palliseri* in three sites of cloud forest during four seasons

Considering the variation of environmental parameters throughout the seasons, SIMS can be considered as the season with quite harsh environmental conditions at HPNP in 2017 (Table 1).

Table 1. Variations of environmental parameters during the main climate seasons of HPNP in 2017

Seasons	Ambient Temperature (°C)	Relative Humidity (%)	Wind Speed (km/h)	Rainfall (mm)
FIMS	19.96 ± 0.01	90.69 ± 0.08	6.22 ± 2.36	168.8 ± 97.44
SWMS	17.58 ± 0.68	95.51 ± 1.37	7.307 ± 2.64	146.64 ± 83.94
SIMS	15.58 ± 0.55	99.4 ± 0.32	15.25 ± 5.71	221.8 ± 32.81
NEMS	18.83 ± 0.44	88.84 ± 0.06	5.03 ± 1.02	42.45 ± 24.96

A positive correlation relationship was obtained in between average temperature variation and average number of individuals recorded during four seasons (Pearson Correlation (r) = 0.995, $p<0.05$) (Figure 6). Negative correlations were acquired in comparing the abundance with average relative humidity (r = -0.919, $p>0.05$) (Figure 7), average wind speed (r = -0.854, $p>0.05$) (Figure 8) and average rainfall (r = -0.520, $p>0.05$) (Figure 9).

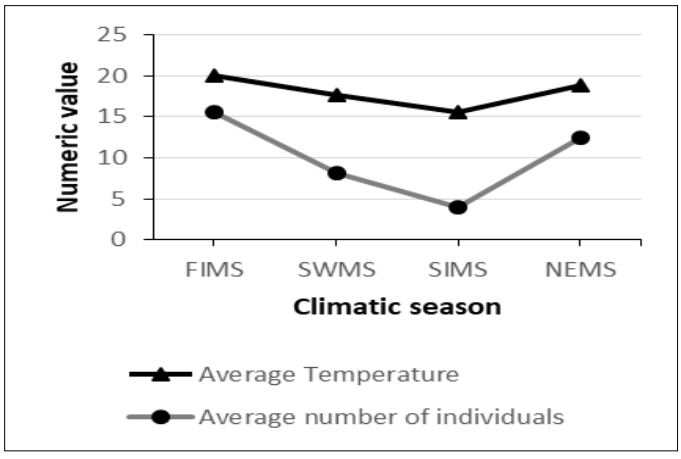

Fig 6: Relationship between temperature and the abundance of *E. palliseri*

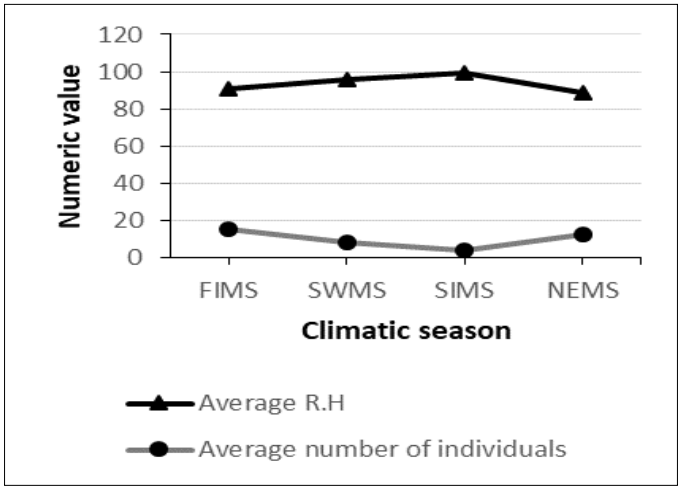

Fig 7: Relationship between average relative humidity and the abundance of *E. palliseri*

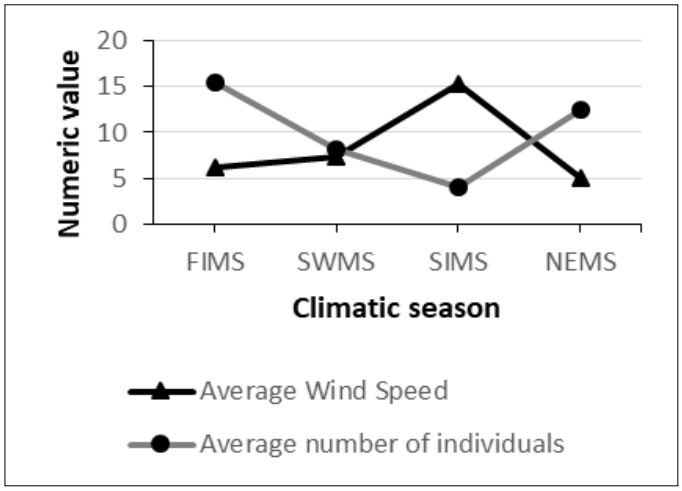

Fig 8: Relationship between average wind speed and the abundance of *E. palliseri*

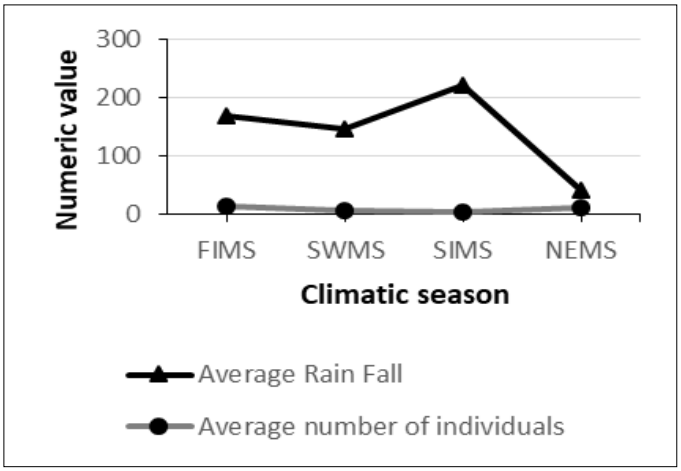

Fig 9: Relationship between average rainfall and the abundance of *E. palliseri*

4. Discussion

E. palliseri generally occurred throughout the year in the HPNP. *E. palliseri* individuals occurred among all four climate seasons in the HPNP. Although their seasonal abundance is not statistically significant within four main seasons there was a difference of seasonal distribution of *E. palliseri* within and between the habitats during the study period. In SIMS of 2017 Horton plains experienced quite harsh environmental conditions with lowest temperature, highest relative humidity, highest wind speed and highest rain fall. Considering the breeding season of *E. palliseri* during the onset of first breeding season in NEMS and FIMS when breeding activities (chasing and territorial behaviors) were observed they experienced optimum environmental conditions. In NEMS and FIMS, slightly high temperatures (18.83 ± 0.44 and 19.96 ± 0.10 °C), lower relative humidity values (88.84 ± 0.06 and 90.69 ± 0.08%), lower wind speed levels (5.03 ± 1.02 and 6.22 ± 2.36 km/h), lower rain fall in NEMS (42.45 ± 24.96 mm) and moderately high rain fall in FIMS (168.8 ± 97.44 mm) were recorded and these conditions facilitated the breeding activities of *E. palliseri* by providing favorable climatic conditions. Therefore highest number of individuals including breeding couples were encountered in February and March months.

Moreover, in SWMS juvenile feeding was observed. During this season climatic conditions were positively affect to their successful performances. Hence in June and July prominent number of individuals including parent birds with juveniles were recorded. But in SIMS *E. palliseri* was not encountered within die back habitat where canopy cover is lower than cloud forest and they tend to be restricted in cloud forest which gives them the most favorable place to obtain protection from strong wind in SIMS than other habitats. However climatic conditions in SIMS affect quite negatively for their secondary breeding season which start in September. That could be another reason for their distribution in cloud forest edges and deep forest.

Bush warblers who attained breeding stage may tend to reach forest edges as it can be identified as the preferable habitat type of *E. palliseri* with good conditions for successful breeding even though there were harsh climatic conditions. Therefore birds who did not attain breeding stage may be entered into deep forests for seeking shelter. The microclimate hypothesis also states that sedentary understory insectivores react more unfavorably to microclimate fluctuations in forest fragments than more mobile species that are frequently exposed to different microclimates [11]. Forest fragmentation and climate change also affected for their disappearance from tropical forests [12]. However HPNP and surrounding areas bear unique weather pattern which can be totally unpredictable. Sometimes they may be perform local migration in seasons with harsh environmental conditions.

5. Conclusion

Current study identified that there are differences in distribution and abundance of *E. pallisei* with respect to the seasonal climatic variation at the HPNP in 2017. There was a relationship between the abundance and environmental variables. Further researches are needed to determine how are they react to harsh climatic conditions and whether they perform local migration with respect to the unfavorable conditions. Finding of the present study warrants further studies regarding to *E. palliseri* for their conservation.

5. Acknowledgement

We would like to thank the Department of Zoology, University of Sri Jayewardenepura for providing us transport and laboratory facilities during the research project. . We extend our gratitude to the Department of Wildlife Conservation for granting permission to carry out this study (Permit No. WL/3/2/29/17).

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