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Abundance, Nesting and Habitat for White-browed Sparrow-Weaver (*Plocepasser mahali*) in Northeastern Selous Game Reserve, Tanzania

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ABSTRACT
Studies on abundance, nesting and habitat for White-browed sparrow-weaver (*Plocepasser mahali*) in Northeast Selous Game Reserve, Tanzania are scarce. This study's objective was to carry out a study on abundance, nesting and habitat for *P. mahali* in order to alleviate such knowledge gap. The transect point sampling was used in sampling the birds, plants, and nests at each point at specified time. The abundance of *P. mahali* was observed to be affected by habitat type, where the woodland scored the highest. Burning of habitats was observed to have impacts on the diversity of bird species. However, number of nests was not influenced by abundance of *P. mahali*. We recommend further studies on this species to be undertaken in the ecosystem. Also we suggest species diversity should be used in monitoring the health of ecosystem rather than individual species.

Keywords: Abundance, *Plocepasser mahali*, Nests, Selous Game Reserve.

1. Introduction
The study of birds including White-browed Sparrow-Weaver (*Plocepasser mahali*) is becoming more vital in Africa generally and Tanzania in particular. The Abundance of birds has been studied in many places all over the world. The studies of birds such as their ecology, habitat requirements and how they are affected with altering the world biomes are important for conservation strategies of the species and biodiversity in general. Birds have been used as source of income [1], and key model for measuring the quality of the altered biodiversity. The use of birds as bio-indicators is because of their sensitivity to the alteration of habitats. *P. mahali* mostly populated in dry regions with woodland or wooded grassland suggests that, this species can be well used to monitor the ecology of woodland or wooded grassland ecosystems such as Selous Game Reserve [2].

The Selous Game Reserve (SGR), the UNESCO World Heritage Site since 1982 is found South-eastern Tanzania is among the largest protected areas in the Africa with about 55,000km^2, [3]. For administrative purpose the reserve is divided into eight sectors namely: North (Matambwe), Northeast (Kingupira), East (Miguruwe), Southeast (Liwale), South (Kalulu), Southwest (Likuyu seka), West (Ilonga) and Northwest (Msolwa). The reserve is rich in biodiversity where by big herds of large animals are found and over 440 species of birds, which makes it bird watching ideal [3,4].The vegetation is mostly *Brachystegia* woodland ('Miombo') (50 %), followed by open savannah (40 %), wetlands (5 %), mountains and inselbergs (3 %) and riverine and montane forests (2%). There are 21 vegetation types and the preliminary surveys indicated 191 species of trees and shrubs [3]. More than 130 species insects have been recorded in Kingupira [5] Despite of the wealth information on large mammals, birds, insects and habitats types, very little is known on abundance, nesting and habitat of the *P. mahali* in SGR.

P. mahali, a member of family passeridae is among common and conspicuous avifauna in the Northeast SGR. The species distribution in Tanzania is limited to South-central of the country preferring dry areas with bush and wooded vegetation [6], documents the species to be numerous in Selous ecosystem while being least in other place in Tanzania. In Africa its distribution ranges from South to Central-eastern Africa in the countries of South Africa, Namibia, Botswana, Zimbabwe, Zambia, Malawi, Mozambique, Tanzania, Kenya, Uganda, South Sudan, Sudan, Somalia and Ethiopia [7, 8].

The species ranges from 17 to 19cm (6.7 to 7.5in) in length having broad, white eyebrow stripe and white rump visible in flight [6]. The male has black bill, the female's bill is horn-colored while that of the juvenile is pinkish-brown [9], but generally the sexes are alike, the species is easily identified by its plumage and there is no seasonal change in plumage [10].

The species active build their nests year round. The nests have U-shapes built of dry grasses with one door for breeding and two doors for roosting nests. Both categories of nests are located at the leeward side of a tree, a behavior thought to ensure preservation of many intact nests for breeding and roosting. In addition, their nests are sometimes used by other birds, such as the Red-headed Finch, *Amadina erythrocephala* and Ashy Tit, *Parus cinerascens* [11]. However the information on abundance, nesting and habitat for *P. mahali* in Northeastern Selous Game Reserve was lacking. This study tried to alleviate the existing knowledge gap in Northeastern Selous Game Reserve that is a part of SGR, a UNESCO World heritage site.

The major objective was to study the abundance, nesting and habitat for White-browed Sparrow-Weaver in Northeastern Selous Game Reserve with the following specific objective; to determine the abundance of the *P. mahali*, to determine the vegetation types in relation to number of nests, to determine the relationship of nest number and the abundance of the *P. mahali*. We hypothesized that; there is positive relation between the number of nests and the abundance of the *P. mahali*, difference vegetation types have significant effects on the number of nests and different diurnal time had impact on the abundance of the *P. mahali*.

2. Materials and Method

2.1 Study Area

The study was conducted in the Northeastern sector, Kingupira SGR located at 7º20′10º30′S to 36º00′-38º40′E. Kingupira sector headquarters is located at about 65km Southwest of Utete town, a capital town of Rufiji district. Kingupira Sector is among eight (8) sectors found in the SGR [4]. The SGR is about 6% of the Tanzania's land surface [3, 12]. The Selous ecosystem, which is unique in its natural wildness, ecological and genetic resources, has approximately 90,000 km^2 area. This ecosystem has the following components, Selous Game Reserve (55,000 km^2), Mikumi National Park (3,000 km^2), Udzungwa National Park (1,900 km^2) and Kilombero Game Controlled Area (6,500 km^2), Peripheral areas (7,500 km^2) [3].

2.2 Sampling

Two transects of 100m long each were selected randomly. In each transect, 7 quadrates of 10mX10m size were located at interval of 100m. In each quadrate, the number of trees, shrubs, and herbs were counted. The number of *P.mahali* and other birds were counted in each quadrate for the standardized time of 5 minutes. The number of trees, shrubs and herbs with *P.mahali* nests were counted. Nests were classified into roosting, breeding, active and inactive nests. Roosting nests were the ones with two openings for doors at two nest extremity sides, breeding nests were the ones with only one opening for door, active nests were the ones with recent bird droppings intact and not tore, and the inactive ones were tore, old, loosely hanged without any sign of being in use. Transects walk and bird counting were done from 0630hrs in the morning to 1400hrs, that is about 8hours per day. The data collections were done in the dry season, September 2013. Only birds seen were counted, identified and recorded. Birds that vocalized without been seen were identified and recorded whenever it was possible but not counted. The fire status of the quadrates was also recorded, that is either burnt or un-burnt.

The habitat types were identified into woodland, wooded grassland, bushland, grassland, and shrub grassland.

The variations in abundance of *P.mahali* and number of nests for different habitats were tested using Kruskal-Wallis Test Statistic. The differences in abundance and number of nests between burnt and unburnt areas were tested using Mann Whitney U test statistic. Shannon Weiner index was used to determine the diversity of birds in burnt and unburnt areas and tested using special t-test (Randomization Test) [14]. The correlation between number of nests and abundance of *P. mahali* was determined using Spearman's post correlation index.

3. Results

3.1 Abundance of Birds

Generally the total abundance of all birds recorded during the study was 1,278 (Mean=31.171±5.097, SD=32.636) with a minimum and range of 1 and 77 respectively. Different habitat types showed variation in number of birds, for instance Bush land had highest abundance followed by woodland while grassland had least abundance of bird (Figure 1), however the difference was not significant (Kruskal-Wallis Test Statistic = 5.680, P>0.05).

When the abundance of birds were compared between the burnt and the unburnt habitats, the abundance difference between unburnt (Mean=22.475±5.361, S.D=33.903) and burnt (Mean=9.475±2.976, S.D=18.822) was not significant (Mann-Whitney U test statistic=198.500, P> 0.05).

3.2 Abundance of *P.mahali*

The total abundance of the *P.mahali* was 13.85 % (Equivalent to 177 individuals) of all birds observed during the study. The most abundance was observed to occur in the woodland (Mean=3.024±1.567, S.D=10.036, n=41) and least abundance occurred in grassland (Mean=0.049±0.034, S.D=0.218, n=41). The difference among habitats was significant (Kruskal-Wallis Test Statistic = 13.862, P<0.05).

In comparison between the burnt and unburnt areas, the unburnt area (2.207± 0.674, S.D= 0.434) showed highest abundance than the burnt area (Mean= 3.759± 0.795, S.D= 0.434), this is illustrated in figure 2, but the difference was not statistically significant (Mann-Whitney U test statistic = 227.000 P>0.05).

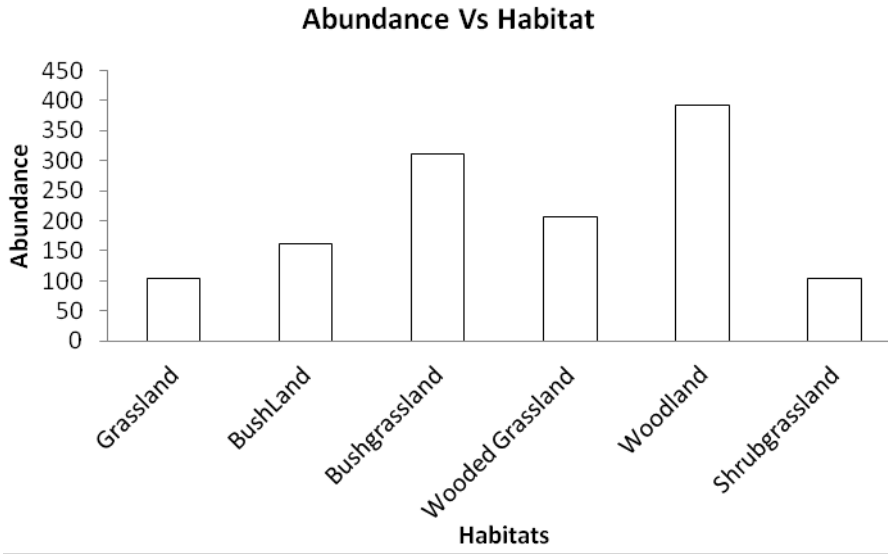

Fig 1: The abundance of birds in different habitat types

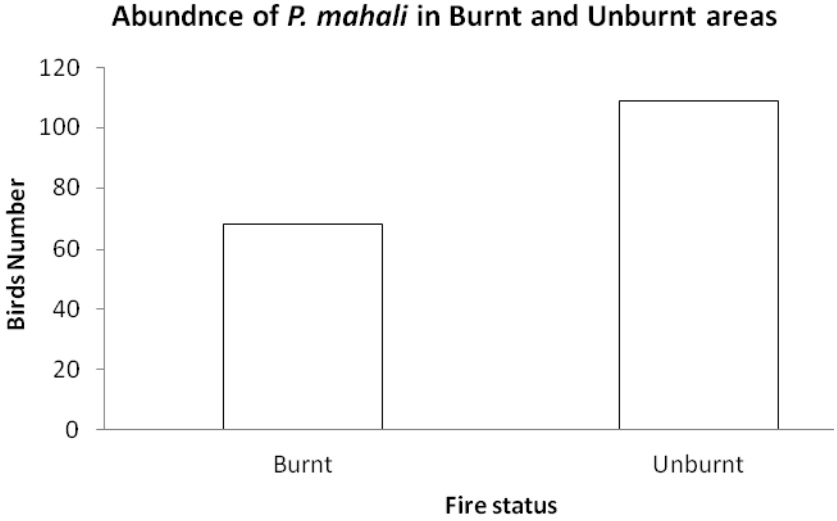

Fig 2: The abundance of *P.mahali* in the burnt and unburnt area

3.3 Diversity of Birds

In overall about 11% (Equivalent to 47 species) of the species found in the SGR were recorded in Kingupira during the study. The unburnt area had more species (36 species) diversity of birds than the burnt area (31 species). Most of the diversity indices showed that the difference was statistical significant (Table1).

Table 1: Diversity indices of birds in burnt and unburnt areas with their t and P-values found through Randomization Test

Diversity Index	Burnt	Unburnt	T	P-Value	Conclusion
Shannon Weiner	2.4659	1.9787	0.487229	<0.05	Significant
Simpsons	8.3966	4.6031	3.79357	<0.05	Significant
Margalef	5.0241	5.3322	0.3081	>0.05	Not Significant
Equitability	0.64047	0.51392	0.126548	<0.05	Significant

3.4 Number of Nests

A total of 159 nests were recorded during the study. The number of active and roosting nests was higher than that of inactive and breeding nests respectively (Figure 3). However the difference among categories of nests was not statistically significant (Kruskal-Wallis Test Statistic = 27.67, P>0.05). In comparison between different categories of nests, there was no difference for different pairs (Table 4). There was a positive relationship between the number of nests and abundance of *P. mahali*, nevertheless the relationship was not statistically significant (Spearman's post correlation index= 0.4218, P>0.05). This is illustrated in Figure 4.

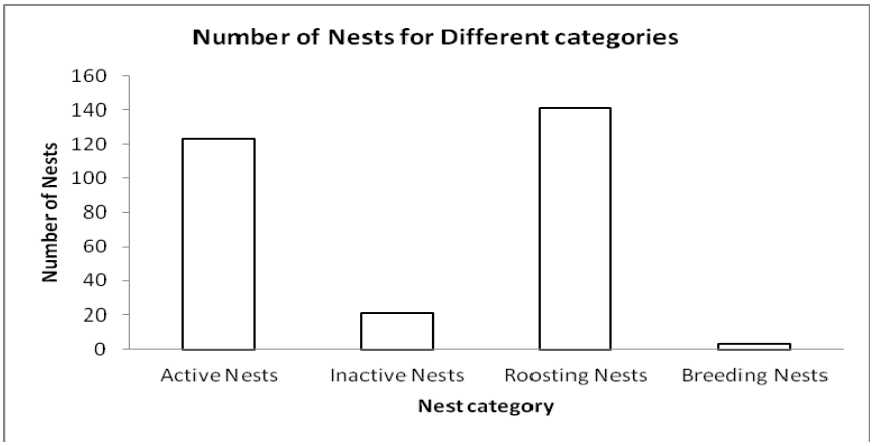

Fig 3: Number of nests for different categories, was Breeding Nest, Roosting nest, Active Nest, and inactive Nest**.**

Table 2: The variation between different types of nests compared using Mann-Whitney U test statistic, were AN=Active Nest, IN=Inactive Nest, RN=Roosting Nest and BN=Breeding Nest.

Comparison category	U	P Value	Conclusion
AN Vs. IN	849.500	>0.05	No difference
RN Vs. BN	770.000	>0.05	No difference
AN Vs. RN	831.500	>0.05	No difference

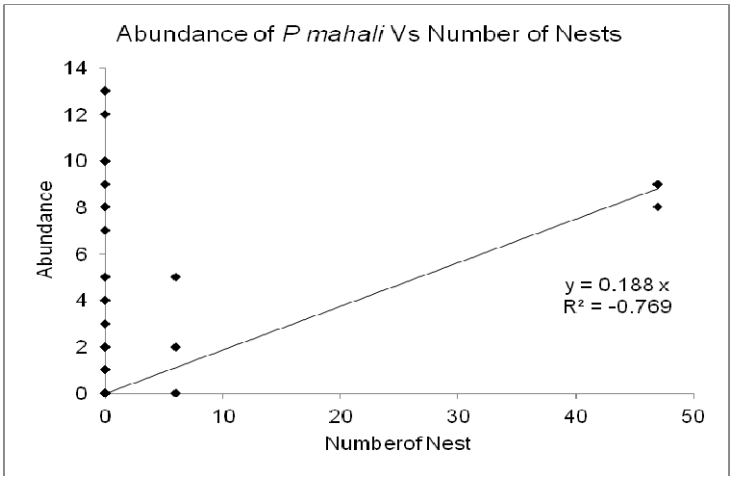

Fig 4: The relationship between the Number of Nests and Abundance of *P. mahali*.

3.5 Vegetation type

The average number of vegetation categories varied differently. For instance, the average number of shrubs was the highest (Table 3),
however the difference was not statistically significant (Kruskal-Wallis Test Statistic = 18.85, P>0.05)

Table 3: Descriptive statistics for different categories of vegetations

Parameter	No. of Trees	No. of Shrubs	No. of Bushes
Mean	1.76	6.73	8.05
sample variance	2.39	174.80	34.55
sample standard deviation	1.55	13.22	5.88
Maximum	5	52	18
Range	5	52	18
standard error of the mean	0.24	2.06	0.92
1st quartile	0.00	1.00	3.00
Median	2.00	3.00	7.00
3rd quartile	3.00	6.00	14.00

4. Discussion

4.1 Abundance of Birds

In overall the abundance of birds was not affected by the habitat type and the fire status. In contrast, habitat and fire status was observed to affect the abundance of *P. mahali*. This possibly can be explained by difference in niches offered by

different habitats. For instance, the higher abundance of *P.mahali* in woodland than grassland can be due to different strata offered by woody plants. These wood plants provide variety of placements for nests, protection against predation, supply of food and conducive microclimate for this species.

4.2 Diversity of Birds

SGR is having over 440 species of birds [3]. The 47 species identified in Kingupira is just 11% of the overall species of bird in SGR. The low diversity in the area can be explained by the small study area, as the study was done around the Kingupira camp. Also the dry season in which the study was carried may influence presence of some bird species especially migratory, this would be clear if the study could be carried through the dry and wet seasons.

In comparison between the burnt and unburnt areas, higher diversity of birds was observed to occur in unburnt area. The unburnt area perhaps offered greater resources in terms of food, microclimate, shelter, and breeding sites. For instance during the study we noted that the unburnt area near Kingupira camp had water pipe leakage which attracted variety of birds. In addition a study done in SGR to determine the impact of fire on insect showed that, unburnt area attracted more insects than the burnt area[5].his can explain that, insectivore birds will be more attracted in the unburnt area. In addition, the unburnt area was observed to have plants which supplied seeds for seed eater birds.

4.3 Number of Nests

We hypothesized that; the number of nests would correlate with the abundance of the *P. mahali*. Also the thought was, there would be variations among nest categories. However the results showed oppose scenario. This shows that, nests does not attract the birds rather that, resources like water, foods, protection and habitat type. For instance in this study certain species of plants and the reeward side had the highest number of nest, which made to suspect that further studies should be done to compare the number of nests in different plant species and wind direction. Other studies have shown that, direction of wind, solar radiation, humidity, thermal radiation have influence in the placement of nests. In addition, White-browed Sparrow-Weaver nest placement appears to be an adaptation for having large numbers of intact nests available for breeding and for roosting throughout the year [11].

5. Conclusion and recommendation

5.1 Conclusion

Conclusively, habitat heterogeneity affected the abundance of *P. mahali* while the burning affected the diversity of birds. Also nest placement and quantity of nest was not correlated with the abundance of *P. mahali*. Furthermore, the amount of nests was not predictor of roosting or breeding nest in this study.

5.2 Recommendation

We recommend that,

Further studies should be done to determine the more factors which determine the position of the nest in Selous game reserve for *P.mahali*.

Bird diversity rather than abundance of specific species can be used to monitor the biodiversity health in this reserve.

Further studies of birds in inhabited are in Kingupira and their surrounding area should be done, for it is suspected that that, during dry season more birds are attracted in this area due to water shortage inside the reserve.

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