

(B) Summary of the Report

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A: Contract Number : RG/98/B3

**Distribution and Habitat relationships of Birds Reptiles and Amphibians in
the Knuckles Region of Sri Lanka**

Summary

Habitat relations of birds, reptiles and amphibians were studied at the Northern flank of Knuckles region central province of Sri Lanka with the objectives of determining the impact of altitudinal variation and land use pattern on their species diversity and distribution. Nine different habitats including disturbed habitats at different altitudes due to human interferences, were selected from three elevations for the study .The study was conducted from March 1998 to July 2003, and covered an area of 6 km². The methodologies used in this study were diverse, as they were specific to each taxon. Land use maps of the Knuckles Region were used to identify the different land-uses in the study area(Survey Dept, 1988)

- Different land uses were used to cover the diverse combination of habitats.

- Avifaunal, amphibian and reptilian surveys were conducted in the selected representative habitats for species richness, abundance and habitats occupation
- Avifaunal surveys were carried out covering migratory as well as non migratory seasons to find out the habitat relations of them..
- Line-transects, circular plot counts and mist net (Bibby et al 1993) and activity sampling methods (Altman 1971) were carried for birds studies while quadrat sampling, visual encounters and opportunistic observation were used to study the amphibians and reptiles. Night sampling and observations were also done to study amphibians and reptiles and nocturnal birds.

For amphibians and reptiles 1 Quadrat sampling (Ronald, et al 1993) Opportunistic observations methods were used as common methods. However Audio strip Transects method was exclusively used for amphibians

An 8m x 8m quadrat made, out of water proof material and four iron rods was erected in selected plots in the study sites. Leaf litter, rock boulders, logs and fallen branches were removed manually within a short time. The soil was scraped to a depth of 5cm. within the quadrat. All amphibians found within the quadrat were collected by 6 to 8 field workers as they were found. The live animals were placed in plastic bags, identified in the field and released in the same habitats in which they were found. Animals that escaped from the quadrat were followed and captured for identification and released thereafter.

Audio strip Transects was based on identifying amphibians by their calls. Male amphibians during reproductive seasons use distinctive species- specific calls. This method was used to detect the presence of calling frogs along transects or in specific

regions. The environmental parameters of different sites were recorded at the site using standard equipment such as thermometer, hygrometers, ruler, soil moisture meter, etc.

AVIFAUNA

Avifaunal community diversity, composition, status and feeding habits were studied in the Northern flank of the Knuckles region, with the objective of determining their altitudinal variations. A total of 168 species belonging to 41 families were encountered. This constituted 50.6 % of the total bird species recorded in Sri Lanka, to date. This study area represents 65% of the total endemic species and 22% of the total number of winter visitors recorded in Sri Lanka. This community includes 65% of the total number of families recorded in Sri Lanka.

The selected study locations were Riverstone (Altitude 1181-1393m), Pitawala (Altitude 878- 939 m) and Ilukkumbura (Altitude 500- 750 m). From each of these locations, an undisturbed forest habitat, a disturbed forest habitat and a riverine habitat were selected for the study which made the 9 overall habitats studied. Marked altitudinal variation in species diversity was observed among the communities in similar habitats at different altitude.

ANOVA revealed that there is a significant difference among the avifaunal communities in the three locations ($p=.003$, $p< 0.05$). The three different habitats at Riverstone and Pitawala too were significantly different (both had p values of .002,

$p < .05$). In Ilukkumbura the three avifaunal communities were not significantly different, statistically ($p = 0.458$). The Riverstone, Pitawala and Ilukkumbura locations harboured 88, 128 and 136 species respectively.

Both the Shannon Weiner diversity index and Simpson's evenness index were highest (3.829 and 0.99 respectively) at the lowest elevation (Ilukkumbura). These values were lowest (3.255 and 0.93 respectively) at the highest elevation (Riverstone). In addition, the Pitawala–Ilukkumbura populations showed the highest Jaccard's (qualitative similarity index) and Sorenson's (quantitative similarity index) index values ($J = 0.72$, $S = 0.43$) whereas, the Riverstone, Ilukkumbura pair of sites showed the lowest values of these indices ($J = 0.51$, $S = 0.28$). The Riverstone and Pitawala pair came in between, where these values were concerned ($J = 0.57$ and $S = 0.41$). The above facts indicate that the avifaunal community in the Northern flank is rich in endemism and high in diversity. Communities in adjoining sites harbour more common species, whereas it is low, when the sites are far apart in the same geographical area, as indicated by the Similarity index measures.

The food habits of communities in the three selected elevations also indicated variation which were related to the habitat structure. All three elevations had a dominant insectivorous community. Second came the frugivorous communities. The third dominant carnivorous community in each location had percentage values of ascending order, along with the decrease in elevation. This indicates that open areas and low canopy cover are favourable environmental parameters for most carnivores.

It was evident that in spite of the low diversity and richness indices, the higher elevations are home for more rare and endemic species such as the Sri Lanka Yellow eared bulbul, Sri Lanka Wood pigeon, Sri Lanka Bush warbler, Sri Lanka Whistling thrush and the Sri Lanka Dusky blue fly catcher. The lowest elevation on the other hand, provides habitats for a large number of rare migrants (Northern Orange headed ground thrush, the Booted warbler, the Red winged crested cuckoo and the Philippine shrike), along with numerous common species. Therefore it is evident that conservation measures for habitats of avifauna in the Knuckles region must include the entire area encompassing different habitat types at different altitudes to provide sanctuary for endemic, rare and migrant species.

Mixed species flocks of birds were investigated in two altitudes (Riverstone and Pitawalapatana) in the study area. Monthly transect records were made in two fixed transects. A total of 22 and 20 Mixed Species Flocks (MSF) was encountered at Riverstone and Pitawalapatana respectively during the study period. The compositions of MSF were different at the two altitudes, and flocking tendency was high at Riverstone (38%) than at Pitawalapatana (31%). The average number of birds in flocks at Riverstone and Pitawalapatana were 18 and 21 respectively. The flock size in Pitawalapatana was positively correlated with the number of individuals in the flocks while this relationship was negative at Riverstone. The Grey-headed Canary Flycatcher and the Sri Lanka White-eye were nuclear species at Riverstone while the Tickle's Blue Flycatcher and the Common Iora were acted as nuclear species at

Pitawalapatana. At Riverstone there were two main clusters within the flocks, while at Pitawalapatana there were four main clusters within the flocks.

AMPHIBIANS

A study of amphibian species distribution and diversity was, carried out at three selected sites at three different elevation , in the Northern flank of the Knuckles region, Sri Lanka, with the objective of determining their altitudinal variations. The study locations were, Riverstone at an altitude of 1100m, Pitawalapathana at an altitude of 790m and Ilukkumbura at an altitude of 530m. The quadrat sampling method, audio strip transects and visual encounters were used for the study. A total of 383 amphibians comprising of 29 species which included 21 endemics were recorded during the study. 21 species were recorded in Riverstone of which 15 were endemic 11 species were recorded in the Pitawalapathana area and 07 of them were endemic. 12 species were recorded in the Ilukkumbura area of which, 08 endemic to Sri Lanka. Species Diversity and Richness were both highest at Riverstone. The second highest values for these indices were recorded at Ilukkumbura. Lowest Diversity and Richness indices were recorded in the Pitawalapathana area that is situated at mid elevation, with the lowest canopy cover. With the exception of *Rhacophorus microtympanum*, which was found at all three elevations it was discovered that most Rhacophorids were restricted to Riverstone. Bufonids and Microhylids were more or less restricted to the elevations, where the Pitawalapathana and Ilukkumbura sites were. Ranids were distributed at all three altitudes. Results indicate that the study area is a region of very high endemism, and different elevations contain different species and communities. As such it should

be recognized that the lower elevations of the Knuckles region is important together with the higher elevations, in efforts to conserve amphibians.

REPTILES

A total of 33 species of reptiles belonging to 5 families were encountered in the Northern flank of the Knuckles Region . Twelve (12) species were found in Riverstone whereas 11 species were found in Pitawalapathana, the second highest elevation. The largest number (22) of species were encountered at Ilukkumbura, the lowest elevation. The percentage of Reptiles inhabiting the Knuckles Region is around 19% of the Sri Lankan reptiles. Twenty one (21) of them were endemic (21%). This clearly indicates that 19% of the Sri Lankan reptiles and 21% of the endemics are inhabiting the area.

Of the 33 species, **Nine Agamid lizards** (Four species confined to Riverstone, one each to Pitawalapathana and Illukkumbura), five species of Geckonids of which all found in the Northern Flank of Knuckles Region are endemic (**one confined to Riverstone and one to Illukkumbura are (*Cnemaspis podihuna*), rare endemic species**); Six species from **Scincidae**, (**four species from Viviperidae**), one species from **Bataguridae**, **three (3) species from family Elapidae** and **four species from Colubridae**, were inhabiting the study area. It is clear that high abundance of agamid is the significant feature of the study area.

Of the twelve (12) species encountered at Riverstone, Eleven (11) species were endemic and ten (10) species are confined only to Riverstone. Eleven (11) species were present at Pitawala pathana and all of them were found in either one of the other

two sites. Five(5) of them are endemic. Ilukkumbura provides home for twenty two (22) reptiles species and eleven (11) of them are Endemic and ten (10) are confined only to Ilukumbura. These facts reveal that adjacent elevations share high percentages of similar species and becoming dissimilar when the elevations are significant and far apart. This is supported by the Mann-Whitney U test . The test is significant between Riverstone and Pitawalapathan at $P < 0.05$ This valve between Riverstone and Illukumbura is significant ($P < 0.01$)

It is clear that the diversity and the composition of reptiles varies with the changing altitudes. The species richness is high in lower altitudes where temperature is relatively high. As these animals are cold blooded, they tend to prefer warmer habitats to cooler ones. However, due to low mobility and dispersal capacity of reptiles endemism is higher at higher elevations.

This results clearly indicate that reptiles prefer open canopy forests and dry areas to closed canopy. Pitawalapathana is more open than other two elevations. Thus, animals can be exposed to heavy predation as birds of prey are very prominent at the Pitawalapathana site.

It is important to record here that endemic relict agamid: the leaf nosed lizard (*Ceretophora tenentii*) is a habitat specialist and found only at higher altitudes with closed canopy, moist habitats. Field observations revealed that *Cophotis* is extremely rare in this sites. It is clear that majority of endemic relict reptiles were confined to the higher elevations.

Ceratophora tenneti was generally observed in large numbers in undisturbed habitats at Riverstone habitats when compared to the disturbed sites in same location. In addition to *Cophotis ceylanicus*, another *Cophotis* species was encountered in Riverstone that could be a new species. Thus, altitudinal variation would be considered in designing conservation area for this sub Montane region.

Conclusions

It is clear that species diversity shows significant differences among the similar habitats located at different elevations in same geographical area. Undisturbed as well as disturbed habitats contribute to the overall biodiversity and more endemic species are confined to the higher elevation. Lower elevations are also important in providing habitats for migratory species. Importance of elevation depends on the species that are trying to conserve. It was also evident that a clear local migration of species such as Yellow eared bulbul, Wood Pigeon show local migration from higher elevation to lower elevation during harsh period that prevailed there during November to February (colder months). Conservation measures will have to consider elevations, taxa and forest that act as stepping stone for local migration. Thus, land form ecology is very vital in conserving biodiversity of the region and re-demarcating of boundaries of Knuckles Conservation area worth reconsidering. The threats to the vulnerable ecosystem there is continuing and some of the sensitive areas like Pitawalapathana, Riverine habitats and landscape should be brought under strict control and should be declared as sensitive areas with immediate effect to stop further dwindling of the biodiversity.

7. Grantee

1. Prof. S.W.Kotagama

2. Dr. U.K.G.K. Padmalal

3. Ms. B. Z. Nizam

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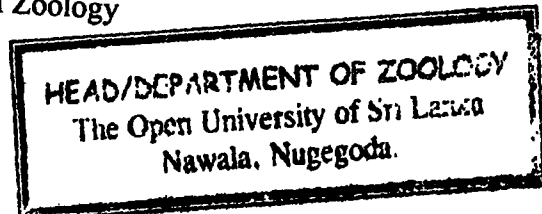
Date: 16/06/2005

8. Comments of the head of the Department of Zoology

Recommended

[Signature]

Signature of the Head of the Department of Zoology



Date 16/6/05

9. Comments of the Head of the Institute/ The Open University of Sri Lanka

~~Recommended~~

Forwarded

[Signature]

Signature of the Head of the Institute/ Department of Zoology

The Open University of Sri Lanka

17/6/05
Date