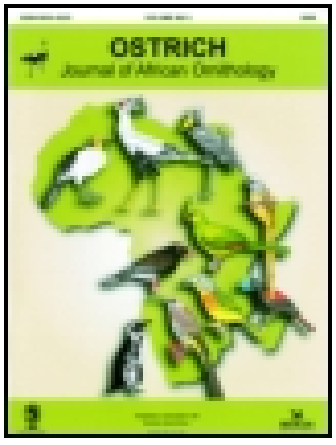


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# The survival of understorey birds in the Tropical Rainforest of Ziika, Uganda

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# The survival of understorey birds in the Tropical Rainforest of Ziika, Uganda

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The forests at the shores of Lake Victoria had considerable attention from researchers during the 1970s. Ziika forest is one of the many small forest fragments that fringe the northern part of the lake. This 12 ha forest is surrounded by different habitats, giving it the appearance of a terrestrial 'island'. Birds were first ringed here from September 1970–July 1972. A follow-up was made in 1988–89, during which 186 birds from 27 different species were ringed. Five years later, survival rates were found to be significantly higher than the expected. Some species appeared to survive better than others. There are various assumptions made in estimating survival rates of understorey birds.



## INTRODUCTION

In general, studies on longevity and survival of individual forest birds in the tropics have received little attention. In Africa a few studies that have been directed towards the understanding of survival include those of Mann (1984) in the Kakamega Forest (Kenya), Dowsett (1985) in a Malawian montane forest, Brosset (1990) rain forest of M'Passa, Gabon and Fry (1980) gave a review of survival rates for temperate and tropical Africa. Another report from savanna habitat was on the Grey-headed Social Weaver *Pseudonigrita arnaudi*, that revealed high levels of annual survival rates (Bennun 1992). The paucity of information on survivorship is partly due to the fact that long term research programmes are rare in African tropical rain forests. In the case of Uganda, during the post-independence period of civil wars, virtually no ringing scheme had operated for a sufficiently long period to produce longevity records.

Elsewhere in the world, substantial information of survival rates exists (Karr *et al.* 1990; Bell 1982; Fogden 1972). The general trend appears to be that certain traits in individual species favour longevity and generally high annual survival rates are characteristic in the tropics.

Ziika forest was selected for this study for three reasons. Firstly, it is small in area, so that a sample taken is representative of the whole population. Secondly, the author considered the population a closed one, owing to the fact that it is surrounded by different habitat types. Thirdly, Ziika is minimally disturbed hence the human influence on birds' survival is unlikely to be significant.

It was hypothesized that (owing to the small area and the isolation of Ziika forest) the birds could not survive as long as five or more years. It was also suggested that the resource base within such a small forest patch might be a limiting factor thereby lowering an individual's chance of survival. Edge effects are more pronounced in such small forests (Whitcomb *et al.* 1981) making the fauna extinction prone. Dranzoa (1990; 1993) had already reported local extinction of a few species in Ziika forest.

The main objectives of this further study were to establish a monitoring program on survival of forest birds in this small forest fragment, and to establish their survival rates.

## STUDY AREA AND METHODS

The study was carried out in Ziika forest, in Mpigi District (Uganda), longitude 32°30'E and latitude 0°10'N. This rain forest is situated on the mainland 11 km along the north-western shore of Lake Victoria, where it bounds the head of a shallow swamp-filled bay off a main arm of the lake (Fig. 1).

Ziika forest forms part of the formerly more extensive Lake Victoria shore forests. Buxton (1951) originally described it as a U-shaped tropical rain forest covering an estimated area of 19.2 ha. Since then, about 5 ha on the southern end of the forest was lost to agricultural encroachment and by the 1970s only 12 ha of the area was left under forest cover. Along its east–west axis, distinct ecological features can be recognised. Beyond the ecotonal edge of the raised dry forest, are scattered thickets on termite mounds in a dominantly grassland vegetation. This is followed by raised dry tropical forest whose water table is not so close to tree roots. This raised dry forest never floods and is characterized by tree species such as *Piptadeniastrum africana* (Hook. f.), *Lovoa trichilioides* (Harms), *Bosqueia phoberos* (Baill.), *Ochna membranacea* (Oliv.) and *Pycnanthus angolensis* (Welw.) Warb. The dominant understorey shrub vegetation comprises *Maytenus undata* (Thunb.) Blakelock and herbaceous layer covered by *Leptaspis corcholiata* Thwaites, *Marantochloa purpurea* (Ridl.) and *Afromomum sanguineum* K. Schum. Below the raised dry forest follows a slightly lower area, which floods occasionally during wet season referred to as wet forest (see Fig. 1). This part of the forest is characterized by tree species of *Pseudospondius microcarpa* (A. Rich.) Engl., *Parkia filicoidea* Welw. and *Macaranga schweinfurthii* Pax and *Raphia monbuttorum* Drude. Beyond the tropical forest, is a permanent swamp vegetation characterized by luxuriant growth of *Cyperus papyrus* interspersed with *Mitragyna stipulosa* (DC.) Kuntze and *Erythrina excelsa* Bak. and *Raphia monbuttorum* Drude. Being surrounded by those different ecosystems gives Ziika an appearance of a terrestrial 'island'.

Rain falls throughout the year in this part of Uganda, with an average 1500 mm per annum. The rainfall pattern is typically equatorial, characterized by two peaks of heavy rains from March–May and September–November. The rest of the months are relatively drier.

Net-lines established in 1970 by Okia (1976), where he trapped on regular monthly basis for 23 months (1970–1972) were used in 1988–89 by Dranzoa (1990). Those same net-lines were reused during this study (1993/94). This was made possible since Okia (1976) had fixed permanent netting points. Trapping was carried out from October 1993 to March 1994. A total length of 100 m of mist nets was set once a week for the six months, altogether 16 weeks were covered. Nets were left opened for an average of five hours. Birds trapped were measured, weighed and checked for other biological parameters and colour banded with only plastic coloured rings. The birds were later released at the site of capture. The use of colored plastic rings alone may introduce some errors in the estimates of survival rates because such rings are known for lack of durability. However, it was assumed that since there are no major climatic variations within the tropical rain forest, losses

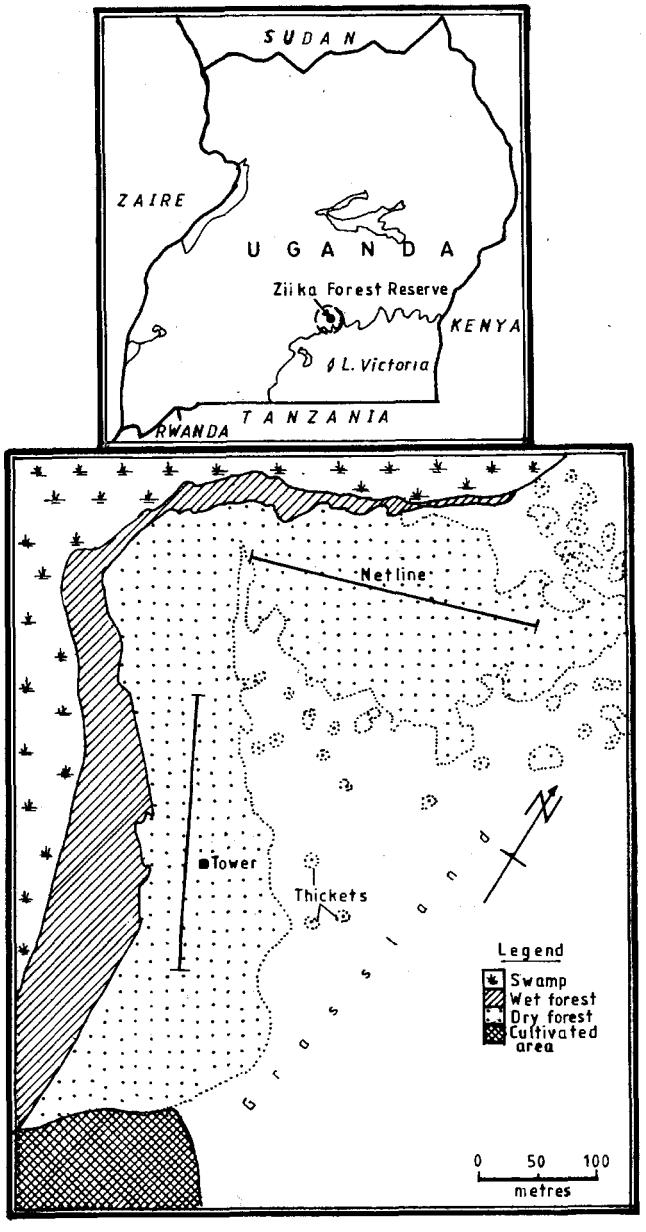


*Fig. 1. A map of Uganda showing the location of Ziika forest: And the study area. The wet forest is seasonally inundated by water during wet season whilst the dry forest is permanently unaffected by seasonality.*

would be insignificant within this ringing regime.

Information on birds other than trapped ones was obtained through timed counts and from opportunistic records.

The following assumptions were made in respect to estimates of survivorship.

a) All adult individuals are from a resident population in Ziika forest (with very few exceptional cases such as the Rufous Thrush *Stizorhina fraseri,* but there is enough evidence to suggest that such exceptions are rare).
b) Individuals that were trapped in 1988–89 had equal chances of being retrapped in this study and that all survivors were retrapped or at least sighted during 1993–94.

## RESULTS

Trapping amounted to 73.5 hours giving a total of 7056 metre net hours.

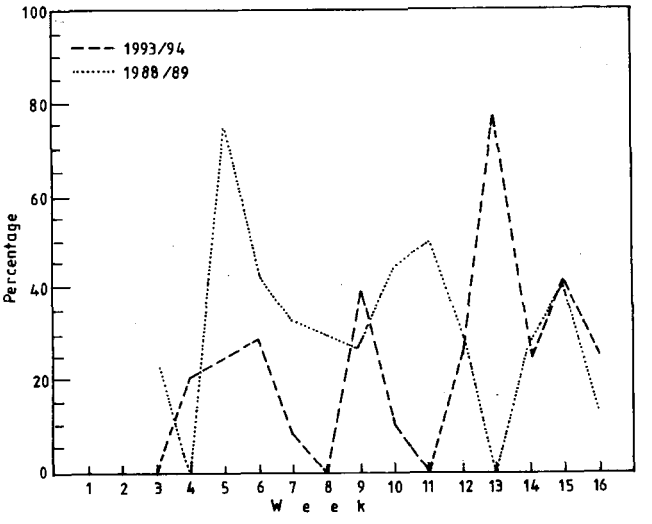


*Fig. 2. The proportion of recaptures at each netting session to indicate the level of resident bird population.*

## Birds retrapped after 5 years

In 1993/94, 26% of the species (N = 27) that were captured five years before were found to have live individuals surviving in the population, with 15.6% of the total number of 186 individuals ringed in 1988/89 surviving. The largest number of individuals that survived were Little Greenbuls *Andropus virens,* White-throated Greenbuls *Phyllastrephus albigularis* and Olive Sunbirds *Nectarinia olivaceae* (Table 1). However, only one or two individuals of Red-capped Robin Chats *Cossypha natalensis* and flycatchers survived. Others that did not survive included: Pygmy Kingfisher *Ispidina picta,* Chestnut Wattle-eye *Platysteira castanea,* Paradise Flycatcher *Terpsiphone viridis* and Black-necked Weaver *Ploceus nigricollis.* Most species encountered were resident (Fig. 2).

Based on data in Table 2 there is a relationship between body mass and survival rate. A positive correlation ($r = 0.67$, $n = 9$, $P<0.05$) was found. So far, the longest-lived species within this habitat (Rufous Thrush *Stizorhina fraseri*) also had the highest average weight (Table 3). Mann (1984) reported a Cameroon Sombre Greenbul *Andropadus curvirostris* with a mass of 25 gm that had lived over 19 years in Kakamega forest in Kenya. More than 50% of the Ziika species are insectivorous in their diet (Table 2).

The expected survival (Fig. 3) for each species was based on the formula for tropical land birds (see Pomeroy 1990), $Y = 66.2–7.44X$. Where Y = arcsin (% annual mortality rate of passerines that is the complement of survival rates). X = Natural log of the mass of the bird (g). Based on data of mortality rates for several groups of animals (i.e. Afrotropical land birds, Eurasian land birds, aquatic birds and land mammals), Pomeroy (1990) demon-

*Table 1. Percentage (%) of individuals that survived until 1994 (all birds were ringed as adults).*

| Species | # ringed 1988–89 | No. | % retrapped |
|---|---|---|---|
| *Phyllastrephus albigularis* | 28 | 10 | 35.7 |
| *Nectarinia olivaceae* | 21 | 5 | 23.3 |
| *Andropadus virens* | 54 | 8 | 14.8 |
| *Cossypha natalensis* | 4 | 2 | 50.0 |
| *Hylia prasina* | 7 | 2 | 28.6 |
| *Terpsiphone rufiventer* | 5 | 1 | 20.0 |
| *Muscicapa griseigularis* | 2 | 1 | 50.0 |

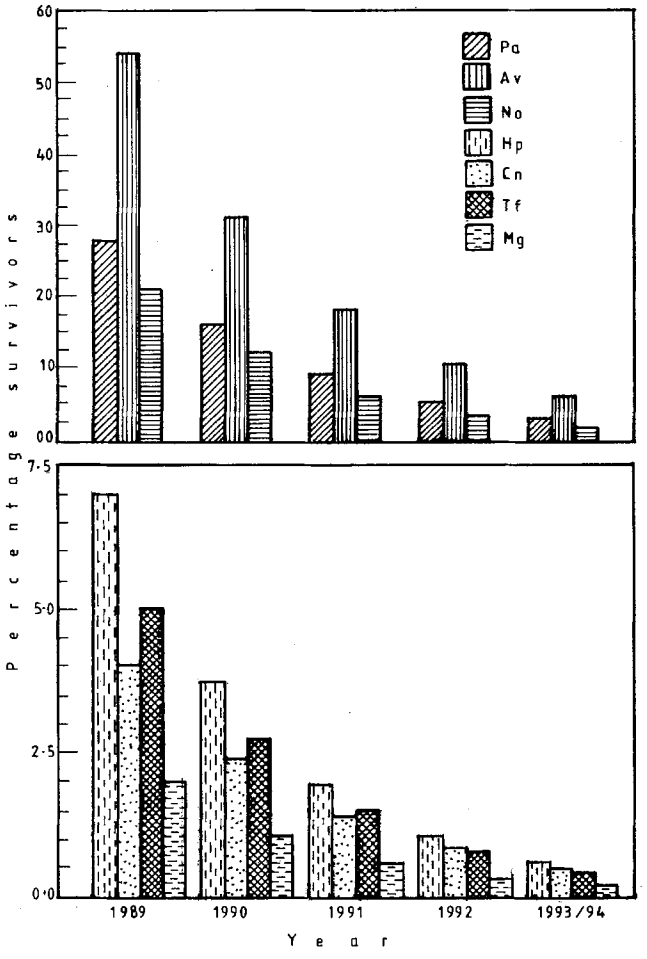


*Fig. 3. The expected proportion of survivors of each species. Expected numbers were worked out by using the formula Y = 66.2–7.44X.*

*Pa = Phyllastrephus albigularis* *Hp = Hylia prasina*
*Av = Andropadus virens* *Cn = Cossypha natalensis*
*No = Nectarinia olivacea* *Tf = Terpsiphone rufiventer*
*Mg = Muscicapa griseigularis*

strated that there were highly significant regressions between annual mortality and body sizes. This shows the strong dependence of mortality or survival rates on body size.

The overall survival of all individuals from the 1988/89 population (N = 186 birds) was 15.6%, a figure much higher than the expected 6.7% (Chi-square test = 24.146 d.f = 1, P<0.001).

## DISCUSSION

The significant difference between the expected and observed percentage of survivors meant that the actual annual survival rate exceeded 80%. Annual survival rates beyond 60% have been shown by Bennun (1992) for Grey-headed Social Weavers in Kenya and in Sarawak and Sub-Saharan Africa, high survival rates of over 80% have been reported (Fogden 1972; Fry 1980; Dowsett 1985; Brosset 1990). Those data sets from various parts of the tropics and from this study are comparably higher than that from the temperate regions (see Karr *et al.* 1990). However, Fry (1980) & Karr *et al.* (1990) showed that there were not significant differences in survival rates between species from the temperate and those from the tropics. These isolated contradicting evidences could probably be a result of comparing large data with small data sets from the two geographical regions.

A number of factors may contribute to the survival of individuals in a population; these may be categorized as either ecological or intrinsic. In Kibale tropical forest ecosystems, Dranzoa (1995) showed that food resource is not as much of a limiting factor as other ecological factors such as availability of breeding sites. In a separate study, Nummelin (1989) showed that there is not much seasonal fluctuation of forest arthropods in Uganda's Kibale forest. According Fogden (1972) food was a limiting factor in the Sarawak forest, but insects were relatively evenly distributed in both time and space. Probably such is the case in most forests in the tropics including Ziika, in which case, the availability of insects as a food resource may explain the relatively high survival of the insectivore group in forest remnants like Ziika. This is further supported by Fogden's (1972) data, in which over 78% of all the adults that survived were insectivorous species and the rest have insects forming part of their diet. Besides, birds that are not highly specialized feeders are known to show dietary shifts, hence off-setting lean periods (Bell 1982).

Individuals less predisposed to environmental stresses such as food resources may live longer. Because tropical forest arthropods are extremely diverse and have small population fluctuations compared to other taxa in tropical forest ecosystems (Nummelin 1989; Obua 1993), such a pattern could explain why insectivorous species fare much better than others such as obligate fruit eaters.

Only one Rufous Thrush that was ringed in 1971 in one of the lake shore forests was retrapped in 1989 from Ziika. But none of the birds ringed in 1970 (Okia 1976) were retrapped. This probably suggests that none of the understorey bird community in Ziika forest live longer than 15 years. Causes of mortality in tropical rain forests are not yet well understood and this area merits further investigations.

Contrary to expectation, the survival rates for all the birds was higher than the estimates for the Afrotropics (Pomeroy 1990).

***Table 2:** Characteristics of the species recovered.*

| Species | Mean body Mass(g) | Diet | Mean annual survival rate(%) |
|---|---|---|---|
| *T. rufiventer* | 16 | I | 54 |
| *M. griseigularis* | 12.1 | I | 52 |
| *A. virens* | 24.2 | F/I | 58 |
| *P. albigularis* | 24.9 | I | 58 |
| *H. prasina* | 13.5 | I | 53 |
| *S. fraseri* | 35.6 | I | – |
| *N. olivaceae* (F) | 9.7 | N | 51 |
| *N. olivaceae* (M) | 11.5 | N | 51 |
| *C. natalensis* | 31.0 | I | 59 |

I = Insectivores, F/I = Frugivore/Insectivore, N = Nectarivore.

***Table 3.** List of species and their approximate ages at second capture.*

| Species | Year Ringed | Year Recap. | Min. age(yrs) | #Indivduals |
|---|---|---|---|---|
| *Terpsiphone rufiventer* | 1988 | 1993 | 6 | 1 |
| *Nectarinia olivaceae* | 1988 | 1994 | 7 | 4 |
| *Phyllastrephus albigularis* | 1988 | 1994 | 7 | 9 |
| *Andropadus virens* | 1988 | 1993–4 | 7 | 6 |
| *Hylia prasina* | 1989 | 1993 | 6 | 1 |
| *Muscicapa griseigularis* | 1988 | 1994 | 7 | 1 |
| *Cossypha natalensis* | 1988 | 1994 | 7 | 3 |
| *Stizorhina fraseri* | 1971 | 1989 | 18 | 1 |

This emphasises the variations found locally or on regional basis but the difference could also be due to the small data set in this study.

Although many authors indicate that females are more prone to stress and hence mortality, the data in this study were insufficient to show such differences. It has been suggested that species that live in small habitats have smaller territory sizes compared to large-sized habitats (Dowsett-Lemaire 1983). If this fact applies to other forest reserves then it may help to explain high survival over time.

## CONCLUSION

Mortality or survival rates are important in determining the viability of populations. Such studies are not just academic in nature but also provide an important base for habitat management. Ziika forest therefore, provides a unique opportunity both for establishing the functioning of small populations and determining extinction rates of restricted bird populations in future. Long-term monitoring programmes in this forest and others should become part of management priorities of the ever dwindling tropical forests.

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