Monitoring bird populations in Uganda – the first 25 years

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ABSTRACT

Birds and other biodiversity have been monitored in Uganda for up to 40 years. Waterbirds have been monitored at 32 wetland sites since 1991, and some breeding colonies are regularly counted. Cranes, raptors, nightjars weavers and urban scavengers are monitored less regularly. The Ugandan programme for landbirds, had, by the end of 2008, included more than 950 counts of nearly 500 non-forest species at 39 sites, geographically dispersed and categorised by land use (natural, pastoral and agricultural) and by original natural vegetation (forest, moist savanna, dry savanna and impeded drainage). Counts started in 1983 but regular twice-a-year counts at all sites began in 2004. All landbird counts are Timed Species Counts (TSCs). For analysis, we are currently using a subset of 107 common species. The set of 32 common farmland species has shown a significant increase during this period, as has a set of birds that require trees as a major part of their environment, despite extensive tree-cutting in some areas. Species of conservation concern have also shown a significant increase. Two groups have declined, particularly in recent years – aerial species such as swallows and swifts, and Palearctic migrants, the latter significantly.

INTRODUCTION

Bird monitoring has been established for many years in Europe. Currently, 28 European countries monitor landbirds nationally, with three of the ongoing schemes dating from the 1970s (Klvaňová & Vořišek 2007). A recent review of former and current monitoring activities in Africa (RSPB, unpubl.) listed 85 schemes in 13 countries, of which 69 are ongoing. The longest-running is the landbird monitoring programme in Uganda, with records from 1983 onwards.

In this paper, we aim to show that monitoring common landbirds is not difficult, and produces appropriate results for presentation to policy makers. In Africa, as elsewhere in the world, many species of birds are declining and in need of more effective conservation. In Uganda, the rate of loss of biodiversity as a whole is about 1% per year (Pomeroy *et al*. 2008): similar to the global rate (Loh *et al*. 2005). There has been considerable recent interest in the use of list-based analyses for monitoring (e.g, Roberts *et al*. 2007), and it has been argued that they could be particularly helpful in resource-poor countries. In this paper we review both a traditional and a list-based system and discuss their merits.

METHODS

Bird counting in Uganda has involved a variety of methods but only two have been used for monitoring, namely total counts and timed species counts. This contrasts with Europe, where the predominant methods are transects and point counts (Klvaňová & Vořišek 2007); however, both of these methods have also been tested in Uganda.

Total counts are used in Uganda, as in many other countries, for waterbird censuses, which currently take place at 32 sites, every January and July. As the name implies, all individuals of some 190 waterbird species are counted and, at a few completely open sites, it may indeed be possible to count them all. However, most sites have some aquatic vegetation and in a few places it is extensive, so that species such as Shoebill *Balaeniceps rex*, Jacana *Actophilornis africana* and Little Bittern *Ixobrychus minutus* will inevitably be under-recorded. For these, the counts represent estimates of relative abundance. Waterbirds are also censused at nesting colonies, where the usual unit of measurement is the number of nests. For two species – the Pink-backed Pelican *Pelecanus rufescens* and Marabou Stork *Leptoptilos crumeniferus* – counts are nation-wide (Pomeroy 2002), whilst for others they are restricted to particular areas. We have also attempted total counts of scavenging birds in Kampala (R. Ssemmanda & D. Pomeroy unpubl.). There are methodological problems in counting both colonies and scavengers, but these will not be discussed here.

Total counts are also made, on a regular basis, of Grey Crowned Cranes *Balearica regulorum*, some raptors, and Black-headed and Vieillot's Weavers *Ploceus cucullatus* and *P. nigerrimus* (see Pomeroy *et al*. 2006).

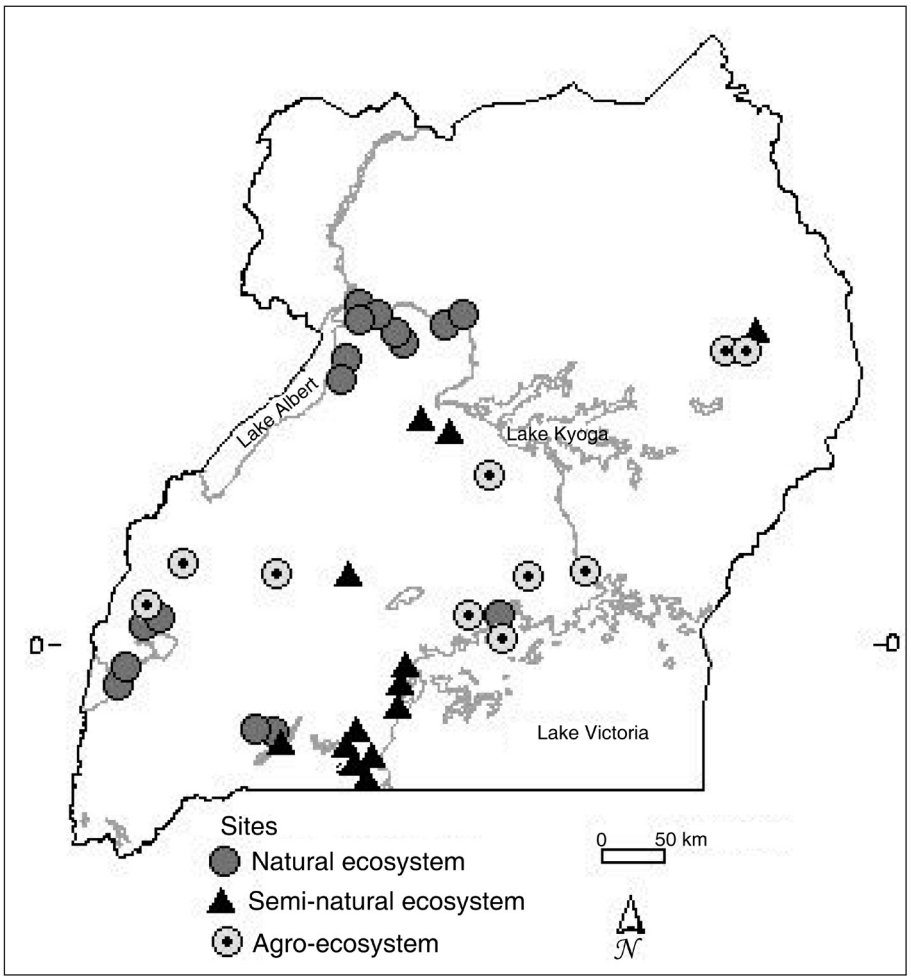

Fig. 1. Location of study sites in relation to land use.

Timed species counts (TSCs) were developed to simplify bird counting in places with many birds and many species (Pomeroy & Tengecho 1986). In these circumstances, it can be difficult to count every individual, as required by point and line transects, but the counts give a good indication of relative abundances. A TSC is essentially a list of species, in the order in which they are seen, during a one-hour period within a specified habitat. In addition, the time is noted at 10-minute intervals so that species can subsequently be scored: 6 for those seen in the first ten minutes, then 5 for the next and so on to 1 for the final ten minutes. Common species will have higher scores not only because they are more likely to be seen near the beginning of a count, but also in a higher proportion of counts. These data generate Poisson distributions from which a new statistic (lambda) can be derived; this is a measure of the rate at which the species is encountered, in other words, a measure of relative abundance (Bibby *et al*. 2000, Freeman *et al*. 2003). The Uganda bird monitoring scheme currently includes about 480 species, almost all of which are non-forest landbirds (there are about 530 such species altogether in Uganda). For the purposes of this paper, we have selected 107 of them. These are generally the commonest species, but the list also included enough of the commoner birds in particular categories, such as raptors and Palearctic migrants, to permit further analyses. There are currently 39 monitoring sites spread across the country (Fig. 1) categorised by:

- Major biome (original natural vegetation according to Langdale-Brown *et al*. (1964)), namely forest, moist savanna, dry savanna, and impeded drainage;
- Current land use, namely natural (National Park or Wildlife Reserve), semi-natural (pastoral areas, which retain much of their original vegetation) and agro-ecosystems (where only fragments of the original vegetation remain).

Each site is visited twice a year, and a lambda value can thus be calculated from the set of 78 TSC scores for each species each year. But prior to 2004, fewer sites were visited in any one year, and the data for earlier years have been grouped, thus 1983–1990, 1991–1995, 1996–2000, 2001–2003. Annual data for 2004 to 2007 give us another four sets, making eight in total.

Few individual species have sufficient non-zero data (the Common Bulbul and Barn Swallow being obvious exceptions), and species were therefore grouped, as follows:

a. Palearctic migrants (7 species, but not including partial migrants such as Black Kite *Milvus migrons*)
b. Afrotropical migrants (8)
c. aerial species, feeding predominantly on the wing (10 species of swifts, swallow and bee-eaters)
d. flycatchers – families Muscicapidae and Monarchidae (5)
e. wetland species – a number of sites included valleys with streams, or areas subject to seasonal flooding (21)

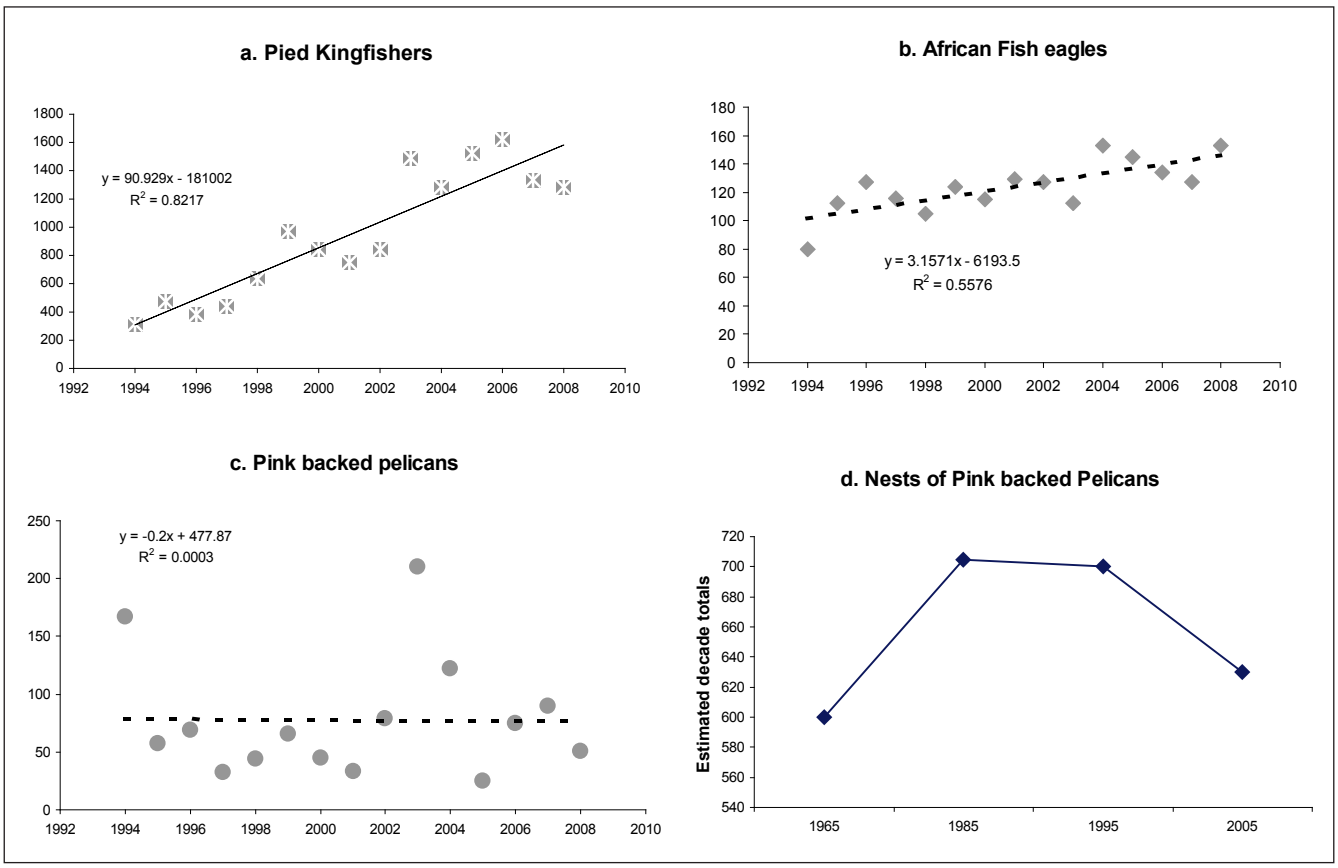

Fig. 2. Waterbird counts for three common resident species. (a, b) from Murchison Falls, Queen Elizabeth and Lake Mburo National Parks; (c) from Queen Elizabeth and Lake Mburo National Park, these being the sites at which they are most numerous. (d) shows the average number of nests in all known colonies in Uganda, per decade, since different colonies were counted in different years.

f. tree birds – species which use trees frequently for nesting, feeding or roosting (44 species – categories FF, F and f of Bennun *et al*. 1996)
g. raptors – diurnal birds of prey (10)
h. grassland species – birds characteristic of relatively open grasslands (12)
i. Red Data species (8: both globally IUCN-listed and regionally as listed by Bennun & Njoroge 1996) (7).
j. agricultural species – birds characteristic of the small-scale farming which is typical in much of Uganda (32).

Each of these groups is of some conservation concern, with evidence from Uganda or elsewhere of species declining. We have calculated indices for each group – and for all species combined by landuse – for each of the eight time periods. Some species belong to two or more groups – e.g, the Barn Swallow.

RESULTS

Three examples of waterbird count data are shown in Figs 2a–c. These illustrate some of the problems in interpreting such counts. Most striking is the four-fold increase in numbers of Pied Kingfishers *Ceryle rudis* and to a lesser extent African Fish Eagles *Haliaeetus vocifer*, for which there is no obvious explanation. Numbers of Pink-backed Pelicans and African Fish Eagles fluctuate much more than might be expected for such long-lived species, probably reflecting their mobility. By comparison, the numbers of breeding pairs of pelicans in all known colonies in Uganda has remained fairly constant (Fig. 2d). Clearly, caution is needed in the interpretation of short-term changes.

Figs 3–5 show the results of analyzing the landbird data. Data for the first four periods, when the set of sites varied in different years, are analysed separately from those for 2004 to 2007, when all sites were visited in each year. Remarkably, all nine data sets (whose constituent species are not mutually exclusive) show increases up to 2003. The probability of this happening by chance is less than one in twenty, according to the Sign Test, although none of the individual increases is statistically significant. One possible explanation would be an increase in observer skills over the 24-year period. To test this, we analysed the data for the Common Bulbul *Pycanotus barbatus*, a species which nobody could miss or misidentify, and three other unmistakable species (the wattle-eye particularly for its calls) (Fig. 4). Three of these four species also show increases in the earlier years, but differ markedly in their recent trends. The trends prior to 2004 strongly suggest that there was a real increase in bird numbers during that period, largely ruling out observer effects. Over the same period, rainfall gradually declined in the north (where we have no sites, Fig. 1 – until recently, the area was insecure), but increased in central Uganda by some 20% from 1991 to 2004, whilst showing no clear trend in the west and east (Magezi in Pomeroy *et al*. 2006). About half of the landbird monitoring sites are in central Uganda (Fig. 1).

Turning now to the various groups of species, and particularly to the most recent years, there are several interesting trends. Most striking is the highly-significant decline in Palearctic species (Fig. 3a). This is not unexpected, in view of the

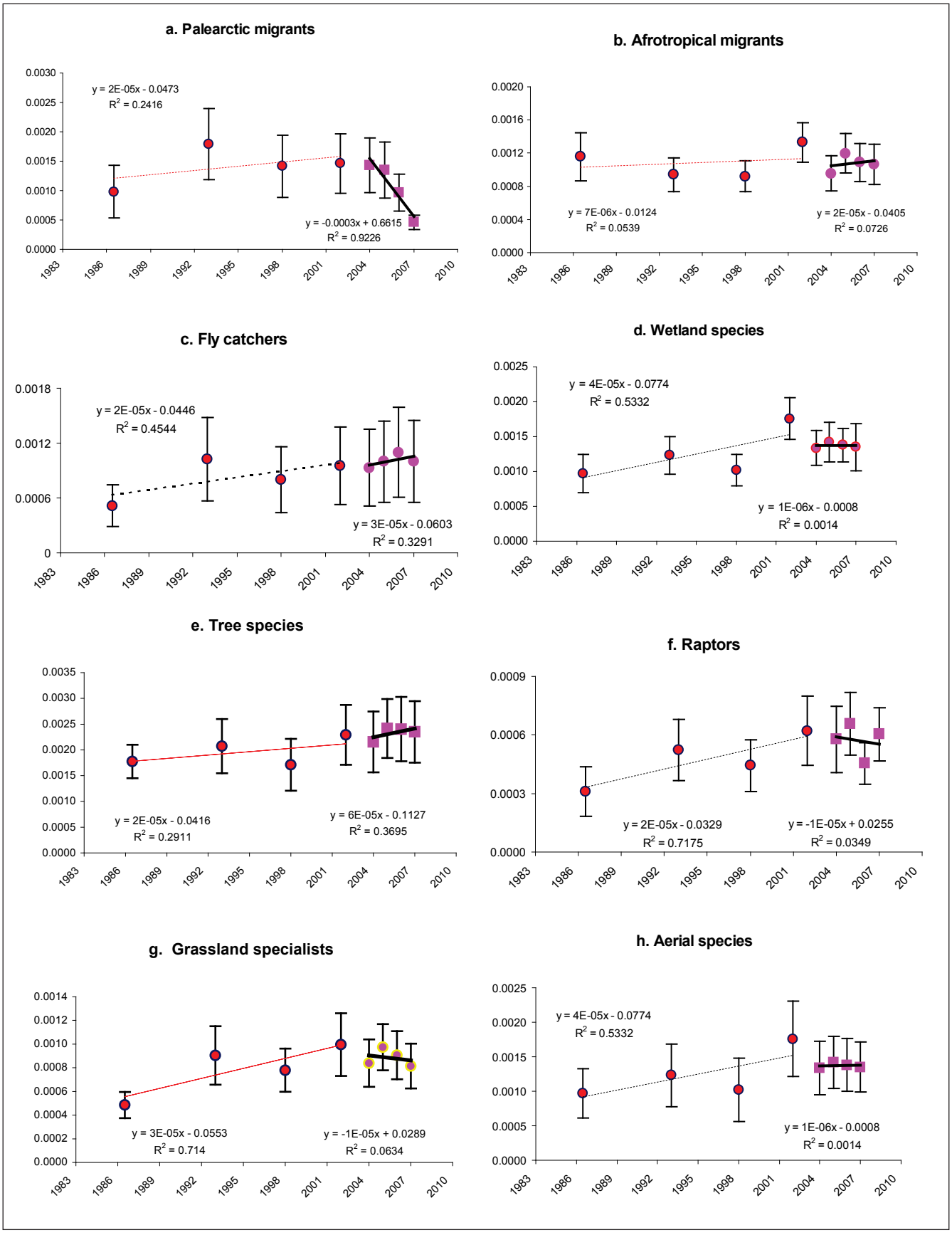

Fig. 3. Trends in relative abundance for various groups of birds (mean lambda values and standard errors). Regression statistics refer to periods to 2003, and 2004–2007, respectively. The species are categories FF, F and f of Bennun *et al.* 1996.

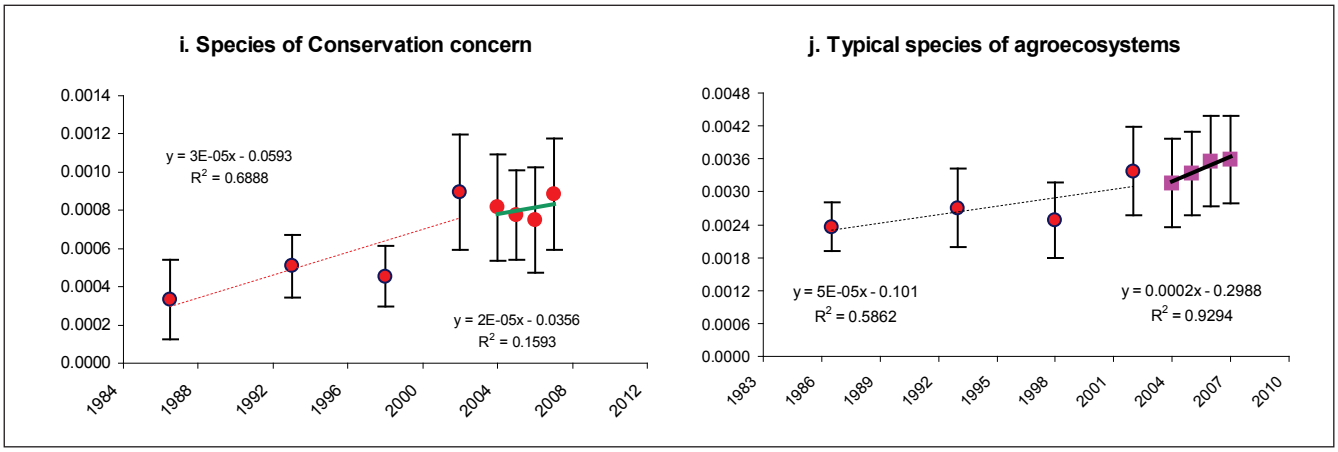

Fig. 3 continued. Trends in relative abundance for various groups of birds (mean lambda values and standard errors). Regression statistics refer to periods to 2003, and 2004-2007, respectively. The species are categories FF, F and f of Bennun *et al.* 1996.

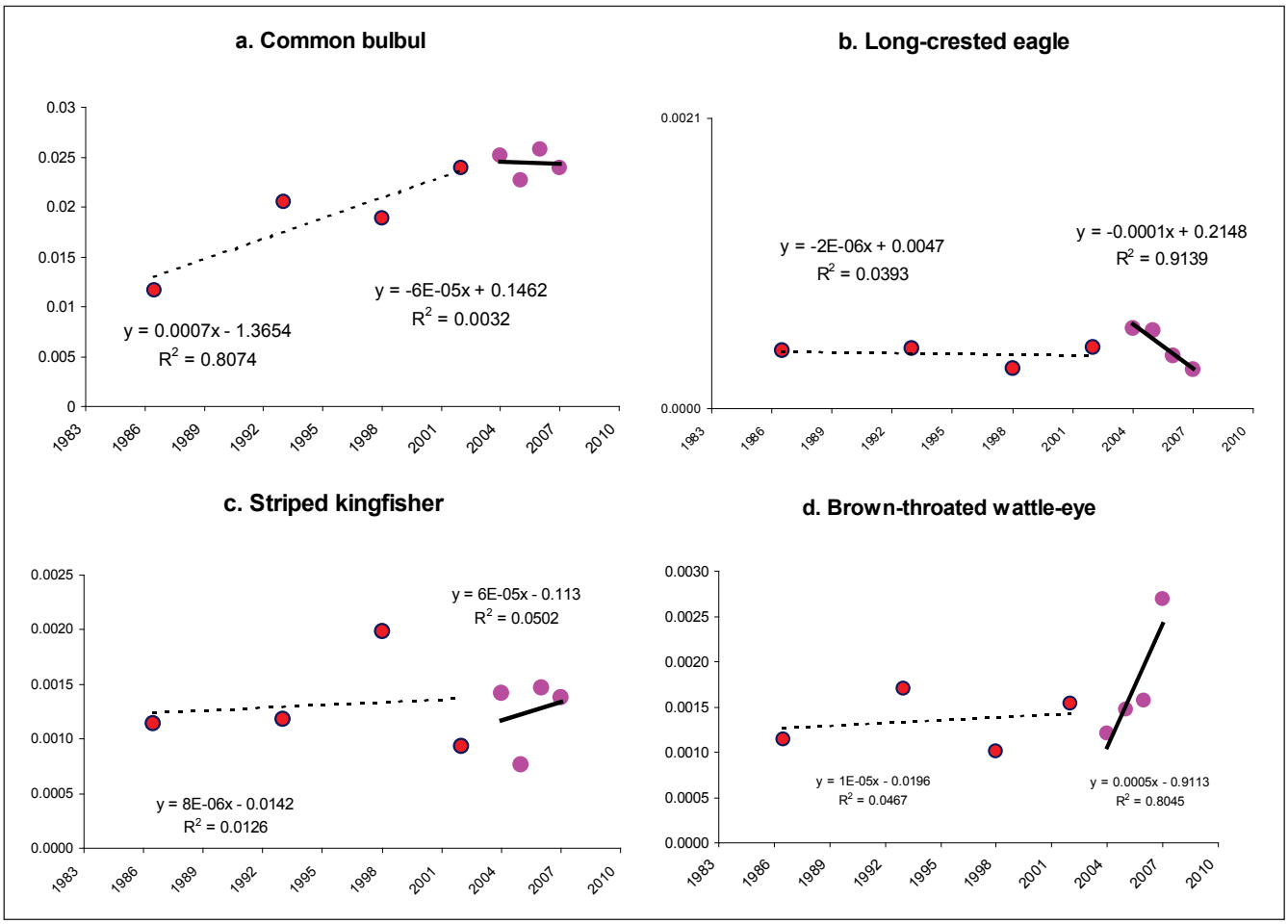

Fig. 4. Trends in relative abundance of the commonest species (a) and three less common but highly conspicuous species; conventions as for Fig. 3. The Long-crested Eagle is *Lophaetus occipitalis*, the Striped Kingfisher *Halcyon chelicuti* and the Brown Throated Wattle-eye *Platysteira pettata*.

widespread decline of these species generally (Sanderson *et al.* 2006). The steepness reflected in Fig. 3 may be partly stochastic: preliminary results for 2008 suggest a partial recovery. Migration is not in itself a likely cause of the decline – there is no such trend for the Afrotropical species (Fig. 3b). Similarly, we found no decline in other groups of insectivorous birds, such as aerial feeders and flycatchers (Figs 3c, d).

In Uganda, as in many other countries, wetlands are being drained and trees cut. So far, however, this does not appear to have influenced the birds for which they are important (Figs 3e, f). This is surprising and deserves closer investigation.

There are suggestions of negative trends for raptors and grassland species (Figs 3g, h) but there is no evidence of a long-term decline in raptor numbers (unpubl. data). Herremans (1998) found that increasing livestock numbers was detrimental to grassland birds in Botswana.

There is obvious interest in species of conservation concern (Fig. 3i) so it is encouraging to find no evidence of a decline

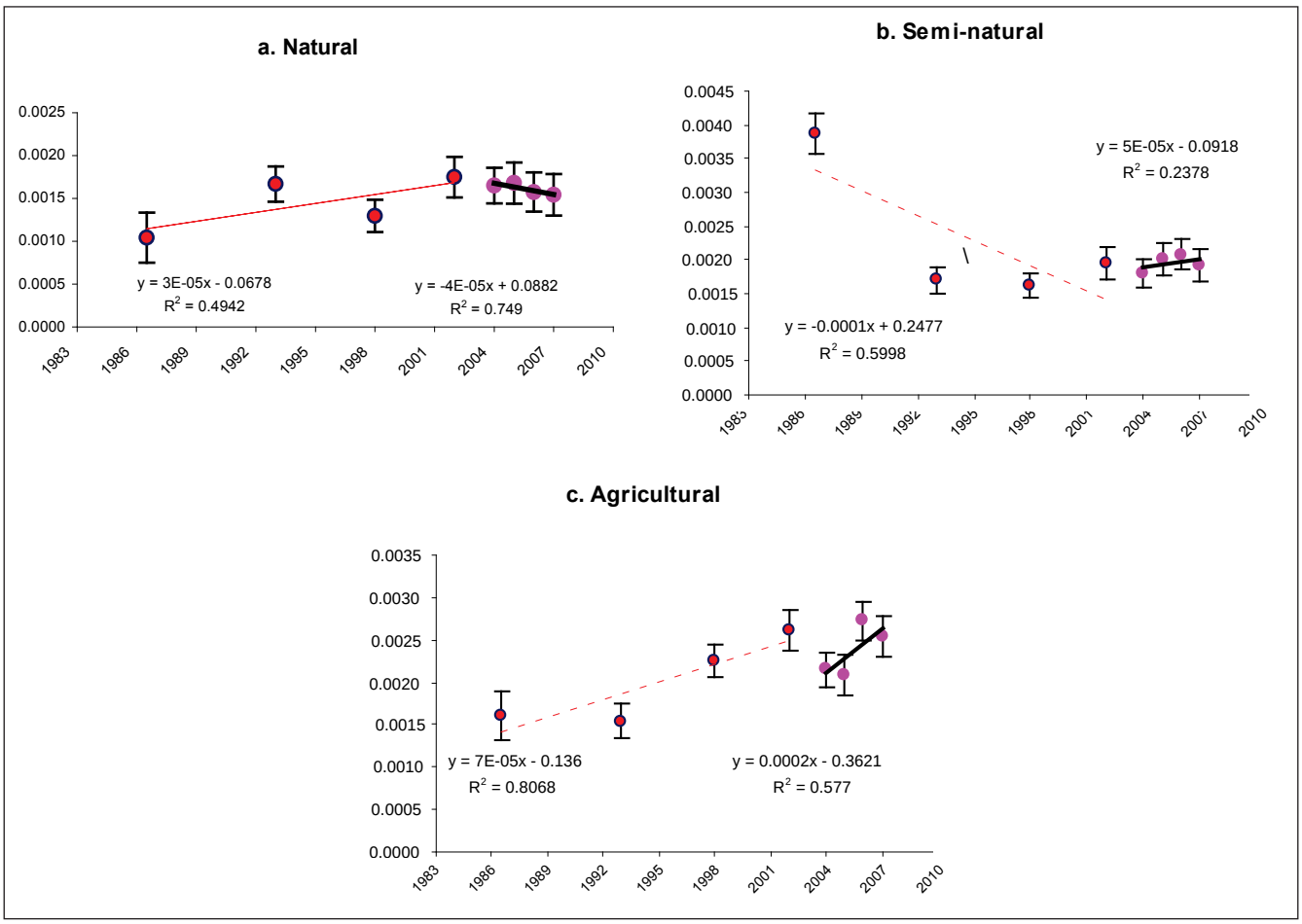

Fig. 5. Trends in overall estimates of mean relative abundance, with sites arranged by type of land use; conventions as for Fig. 3.

in this group. However, the number of birds involved is small (note the small values of lambda). Similarly, the positive trend in birds that are typical of agroecosystems (Fig. 3j), which is significant for the most recent years, can be considered good news – in Europe, many farmland birds are declining (Newton 2004).

When we grouped the data for all sites in each land use category, we obtained the result seen in Fig. 5. The upward trend in early years is still clear in both natural and agricultural areas; the decline in pastoral areas may not be real, as it depends upon a single point.

DISCUSSION

Experience in Uganda leads us to encourage others to develop a national monitoring programme. These are not without difficulties but none should be insuperable. Making counts at widely-separated sites, as may be necessary to achieve good coverage of important habitats, can be costly, so skills at fund-raising can be as useful as those of an ornithological nature. Our experience shows that training in accurate record-making may be as demanding as acquiring identification skills. Being an experienced observer does not necessarily prevent one from making mistakes, particularly when identifying birds by sound, so all records need to be carefully and independently vetted. (Typically, at least 20–30% of land bird registrations in non-forest areas are made solely by sound (unpubl. data)). For a programme to be widely accepted, all these and many other practical points require careful planning and thorough execution. Thus, new programmes tend to develop slowly over a period of years

The results for Uganda so far can best be described as promising. For both waterbirds and landbirds, the comparatively small number of sites adds to the variability of the results and makes it more difficult to detect trends; as Fig. 3 shows, standard errors can be large. Figs 2a and 3 both reveal some interesting trends, some down but mostly upwards: there is clearly much scope for further research. It is probably fair to conclude that birds in general are doing well in Uganda, with the important exception of Palearctic migrants. A possible reason for the increasing trend for landbirds in the 1990s and early 2000s is that the rainfall in central Uganda was increasing at the same time. This will have led to higher primary production, eventually benefiting the whole food chain. However, many things will change over the next few years. More wetlands will be drained and more trees converted to charcoal. Agricultural development and climate change are expected to accelerate. Hence the collection of as much baseline data as possible is desirable, and the sooner the better.

Concerning the choice of methods, we have not discussed total counts in detail, but it is obvious that they are the best where they can be used. However, few if any terrestrial habitats lend themselves to total counts and here TSCs have much to recommend them. They are only one of several methods based upon species lists which can be used to make estimates of relative abundance (Bibby *et al.* 2000, Roberts *et al*. 2007), which in turn can be used as a basis for monitoring (MacNally

2007). List-based methods are subject to a bias when species are being compared, if they differ in detectability – for example, if one is noisy and conspicuous and the other is not. This is less of a problem when comparing relative abundance of the same species across years, particularly when the same set of sites is used consistently (Cao *et al*. 2007).

Where closer estimates of actual abundance are needed (which is not often the case), then transects and point counts can be considered. When used with analyses of distance, these go some way towards overcoming problems of detectability, but they are more demanding of observers and require more time and money.

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REFERENCES

Bennun, L., Dranzoa, C. & Pomeroy, D.E. 1996. The forest birds of Kenya and Uganda. *Journal of East African Natural History* 85: 23–48.

Bennun, L. & Njoroge, P. (eds). 1996. *Birds to watch in East Africa: a preliminary Red Data list.* Nairobi, National Museums of Kenya.

Bibby, C.J., Burgess, N.D., Hall, D.A. & Mustoe, S. 2000. *Bird census techniques* (2nd ed). Academic Press, London.

Cao, Y., Hamukins, C.P., Larsen, D.P. & Van Siokle, J. 2007. Effects of sample standardization on mean species detectabilities and estimates of relative differences in species richness among assemblages. *American Naturalist* 170: 381–395.

Freeman, N.S., Pomeroy, D.E. & Tushabe, H. 2003. On the use of Timed Species Counts to estimate abundance in species-rich communities. *African Journal of Ecology* 41: 337–348.

Herremans, M. 1998. Conservation status of birds in Botswana in relation to land use. *Biological Conservation* 86: 139–160.

Klvaňová. A. & Vořišek, P. 2007. Review of large-scale generic population monitoring schemes in Europe 2007. *Bird Census News* 20: 50–56.

Langdale-Brown, I., Osmaston, H.A. & Wilson, J.G. 1964. *The vegetation of Uganda and its bearing on land use.* Government of Uganda, Entebbe.

Loh, J. Green, R.E., Ricketts, T., Lamoreux, J., Jenkins, M., Kapos, V. & Randers, J. 2005. The Living Planet Index: using species population time series to track trends in biodiversity. *Philosophical Transactions of the Royal Society B* 360: 289–295.

Mac Nally, R. 2007. Use of the Abundance Spectrum and Relative-Abundance Distributions to Analyze Assemblage Change in Massively Altered Landscapes. *American Naturalist* 170: 319–330.

Newton, I. 2004. The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. *Ibis* 146: 579–600.

Pomeroy, D. 2002. The birds of Makerere hill, Kampala – a loss of biodiversity. *Uganda Journal* 48: 1–16.

Pomeroy, D., Lutaaya, B. & Tushabe, H. 2006. *The state of Uganda's biodiversity 2006.* Kampala, MUIENR.

Pomeroy, D.E. & Tengecho, B. 1986. Studies of birds in a semi-arid area of Kenya. III. The use of 'Timed species-counts' for studying regional avifaunas. *Journal of Tropical Ecology* 2: 231–247.

Pomeroy, D. & Tushabe, H. 2008. *The state of Uganda's biodiversity 2008*. Kampala, MUIENR.

Roberts, R.L., Donald, P.F. & Green, R.E. 2007. Using simple species lists to monitor trends in animal populations: new methods and a comparison with independent data. *Animal Conservation* 10: 332–339.

Sanderson, F.J., Donald, P.F., Pain, D.J., Burfield, I.J. & van Bommel, F.P.J. 2006. Long-term population declines in Afro-Palearctic migrant birds. *Biological Conservation* 131: 93–105.