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SEASONAL AND MEDIUM TERM CHANGES IN OBSERVED DENSITIES OF WOODLAND BIRDS IN GROENKLOOF, PRETORIA

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Nothing in nature is immutable; all objects are subject to continual and inevitable changes which arise from the essential order of things.
Lamarck, ca. 1810

Abstract

The changes in observed densities of bird species in a suburban environment in Groenkloof, Pretoria were monitored over five years. The populations of fourteen species were found to increase during the study period and six species were found to decrease. The Amethyst Sunbird *Nectarinia amethystina* was found to be predominantly a non-breeding migrant, and strong evidence for seasonal movements by part of the Karoo Thrush *Turdus smithi* population was produced. Daily movements in and out of the study area are described for some species, most notably the Red-collared Widowbird *Euplectes ardens*. The Grey-headed Bush Shrike *Malaconotus blanchoti* apparently became established as a resident of the suburban habitat during the study period. The medium term changes in density of woodland species were found to be on average significantly smaller than those at a rural site 100 km north of the study site.

Preface

This was a citizen science project in the sense that it was not part of my professional activities. Furthermore, the location of the study site was determined by proximity to the location of my professional activities. No fossil fuels were burnt in the execution of the field observations for this study.

Introduction

Monitoring of changes in avian populations has previously been done on a species by species basis (usually for rare or endangered species). The monitoring of the structure of an entire community of species potentially produces more information about the effects of environmental changes.

In order to understand the changes in bird populations in relation to environmental change, it is necessary to have some idea of the magnitude of the fluctuations in populations that take place in the absence of major environmental disturbances. This study set out to describe the background level of changes occurring in the structure of the woodland bird community in Groenkloof, against which future levels of change can be measured.

Several previous studies have described the structure of bird communities at a site in southern Africa at a point in time (e.g. Tarboton 1980, Herremans 1993, Parker 1997, Monadjem 2002a, Monadjem 2002b, Parker 2005) and a study by van Rensburg et al. (2009) compared the communities of urban, suburban and semi-natural habitats in Pretoria. By the structure of a community I refer to an estimate of the abundance of each species making up the community. I am not aware of any other studies in southern Africa which have monitored the changes in structure of a community over time.

The composition of the suburban bird community is familiar to a large number of people, yet is poorly documented. Bird atlas data (even at the finer scale of the second South African bird atlas project) for the most part do not distinguish between the suburban habitat and other habitats.

Study Area

The study area consists of 100 ha of the suburb of Groenkloof Pretoria (S25°46.4' E28°12.8'; altitude 1400 m), constituting most of the suburb. Pretoria falls in a region known as the 'middleveld', being intermediate both in altitude and climate between the temperate 'highveld' to the south and the tropical Limpopo Valley to the north.

The habitat of the study area consists of suburban homes and gardens, some commercial buildings, two municipal parks (Cilliers Park and the Eugene Marais Park), and the Austin Roberts Bird Sanctuary. Groenkloof is one of the older suburbs of Pretoria and its mostly man-made woodland is more mature than that of most other parts of Pretoria. The Austin Roberts Bird Sanctuary (about 8 ha) consists mainly of a wetland with some open water and extensive reed-beds. The Eugene Marais Park (about 6 ha) contains mainly indigenous trees, shrubs and grasses, while the Cilliers Park (4 ha) resembles a larger version of the private gardens and contains lawns interspersed with trees, shrubs and flowering plants of mixed origin (both alien and indigenous). The study area is bounded to the south and west by Klapperkop Nature Reserve, a protected area of mainly indigenous grassland, scrub and woodland (Klapperkop Nature Reserve is contiguous with further protected areas to the south in the Groenkloof Nature Reserve and the grounds of the Voortrekker Monument), and bounded on the other sides by residential suburbs.

Methods

Transect counts were made at each of five sites within the study area during each month of the study period. A total of 44 counts of adult birds encountered were made during each month. The lengths of the transects were 1 km long at two sites, and 2 km at the other sites. An unknown number of birds would have been overlooked during transect counts. In addition, when counting birds in woodland, there is a difficulty in knowing whether an individual encountered has already been counted or not. A judgement has to be made as to whether it is far enough from the previous encounter for it to be unlikely to be the same individual. In this study, a conservative approach was used so that the number of birds was more likely to have been under-counted than over-counted. The observed numbers could therefore be regarded as a lower bound for the true numbers. The numbers counted were transformed to a density estimate by dividing the count by the estimated area covered. The area was estimated by multiplying the length of the transect by the estimated average distance from the transect line over which birds could be easily detected. While the observed densities may be far from the true densities, by being consistent in counting methods and estimation, it is possible to accurately reflect the changes in density, as well as the relative densities (the density of a species in relation to other species). While there is often great variability in the number of individuals of a species observed from one transect count to the next, when the counts were accumulated over a month, the variability from month to month was found to be encouragingly modest.

Summary of results

The relative standard error (the standard deviation expressed as a percentage of the data value) of the observed density per month was estimated for a few species as an indication of how much variability is likely to be due to random error (Table 1). A low value for the standard error does not mean that the observed value is close to the true value, but it does indicate that the deviations from the true value are consistent. Observed values lying between 5 and 10% indicate that changes in observed density of more than 10% are unlikely to occur by chance and are more likely to represent a real change in density (or a change in conspicuousness in some cases).

Table 1 – *Relative standard errors*

Species	Relative standard error of the observed density
Dark-capped Bulbul	4,5%
Cape Turtle-Dove	5,8%
Hadeda Ibis	10,4%
Karoo Thrush	6,7%

The tendency for some species to congregate in flocks increases the variability of the observed densities and reduces the reliability of the changes in observed densities as estimates for the true changes. The relatively high standard error for the Hadeda Ibis *Bostrychia hagedash* (Table 1) reflects communal roosting by non-breeding birds.

When the observed densities were plotted over time (Figure 1a to Figure 81a), the regularity of the curves was quite startling and this serves as a further indication that the observed changes were predominantly non-random.

The expected pattern of seasonality for woodland birds that are sedentary is of an increase in densities throughout the breeding season, followed by a decline which continues through to the beginning of the next breeding season. For most woodland species in Groenkloof, the breeding season falls mainly during the first half of summer (October to December).

For most species, the observed seasonality differed markedly from the expected, showing (after allowing for changes in conspicuousness) that most species that are not migrants are subject to seasonal movements by part of the population in and out of the study area, over both long and short distances.

For those species of Weavers, Bishops, Widowbirds and Whydahs where the males lose their brilliant breeding plumage in winter, the seasonal changes in observed densities are clearly influenced more by the changes in conspicuousness than by changes in actual densities. In addition, species which forage within the tree canopies become more conspicuous in winter due to loss of foliage. Since the vegetation of the study area is partly evergreen, this effect is less marked here than in a uniformly deciduous woodland.

Given that the suburban habitat provides a relatively constant supply of food and water throughout the year, it may be supposed that birds from the surrounding undeveloped areas might take refuge from scarcity by moving to the suburbs during winter. This study provides some support for this hypothesis, but the evidence is not conclusive.

The presence of a protected area of mainly indigenous vegetation bordering the study area has a significant influence on the study area. Several species were observed to exploit both indigenous and suburban habitats by moving regularly between the two.

Domestic cats are known to kill large numbers of wild birds. Because they occur in higher concentrations in the suburban environment than do any natural predators of birds in the wild, the concern has been expressed that they may pose a threat to the populations of some bird species.

This study did not find any evidence for a decline in any bird species that could be caused by predation by domestic cats (with one possible exception). Those ground-feeding species that one would have thought would be most vulnerable to predation by domestic cats (e.g. Doves, Thrushes, Sparrows and Robin-chats) are in fact more numerous in the suburban environment than they are in natural environments that are relatively cat-free.

The possibility that those species most vulnerable to predation by cats have already been eliminated from the suburban environment needs to be considered. But, if one lists the species which probably occurred in the study area before urbanization (e.g. various Cisticolas, Larks, Pipits, Francolins, Bustards and Secretary Bird *Sagittarius serpentarius*), in all cases the disappearance of these species is more likely to be linked to the absence of the natural grasses and of wide-open spaces than to predation by domestic cats.

The one exception is the Red-throated Wryneck *Jynx ruficollis*, which was at least temporarily absent from the study area at the end of the

study period. Predation by domestic cats is one of the possible causes of its disappearance.

There is a popular perception that some indigenous bird species are displaced by the Common Myna *Acridotheres tristis*, either through predation on the young or by competition for food and other resources. Common Mynas are believed to have displaced indigenous species in some tropical island habitats elsewhere, but evidence for displacement of indigenous species in South Africa is lacking (Peacock et al. 2007). This study found no evidence for displacement of indigenous species by Common Mynas. As for predation by domestic cats, all of the species which have declined or disappeared from the suburb are more likely to have been displaced by habitat modification than by persecution by Common Mynas.

For a number of species the observed densities showed clear evidence for a population increase over the study period, most notably the Speckled Pigeon *Columba guinea*. Other species that appeared to increase were the Speckled Mousebird *Colius striatus*, Southern Grey-headed Sparrow *Passer diffusus*, Cape Robin-Chat *Cossypha caffra*, Black-collared Barbet *Lybius torquatus*, Tawny-flanked Prinia *Prinia subflava*, Streaky-headed Seedeater *Serinus gularis*, Yellow-fronted Canary *Serinus mozambicus*, Cape Weaver *Ploceus capensis*, Black-backed Puffback *Dryoscopus cubla*, Black-throated Canary *Serinus atrogularis*, Cardinal Woodpecker *Dendropicus fuscescens*, Spotted Flycatcher *Muscicapa striata* and Bar-throated Apalis *Apalis thoracica*. The Grey-headed Bush Shrike *Malaconotus blanchoti* appeared to invade the study area during the study period and may now be resident there.

A smaller number of species appeared to decline in numbers over the study period: Laughing dove *Streptopelia senegalensis*, Red-eyed Dove *Streptopelia semitorquata*, Grey Go-away-bird *Corythaixoides concolo*, Common Fiscal *Lanius collaris*, Cut-throat Finch *Amadina fasciata* and Red-throated Wryneck *Jynx ruficollis*. The first four mentioned remain common in spite of the declines.

It must be stressed that an increase (or decrease) in observed densities during the study period is not an indication that the species is likely to increase (or decrease) over the following five years, or over any other time period.

Stability of the avifaunal community

Whereas the composition of the avifauna of Groenkloof has changed dramatically over the last 130 years, it was found to be stable in the medium term (i.e. the five years of the study period).

By contrast, a study of a bird community in indigenous woodland about 100 km north of Groenkloof and remote from urban development, showed far larger medium term fluctuations.

In December of 2009, the red-billed quelea was the most abundant species at that site, with an observed density of over 200 birds per 100 hectares, but in December of 2007, 2008 and 2010, this species was scarce to absent. In the Groenkloof study, no species showed a fluctuation even remotely as drastic.

To show that the Red-billed Quelea was not the only species contributing to the apparently greater fluctuations in composition of the community, the average percentage changes from year to year in observed density for the five most abundant species (excluding the Red-billed Quelea) at each site were compared. The average change for the five most abundant species in Groenkloof from December 2007 to December 2008 and from December 2008 to December 2009 was 5%. This value could not be directly compared to the average percentage changes at the rural site because it was based on a greater number of observations. Therefore the annual percentage change for one of the transects in Groenkloof, for which the number of observations corresponds with that at the rural site was computed. The average annual percentage change was 12%. The corresponding average percentage change at the rural site was 57%.

The relative medium term stability of the suburban bird community can probably be ascribed to the year round availability of water and food in suburban gardens, in contrast to the periodic shortages experienced in more natural environments.

The timing of breeding activity

If this study were to be repeated, more attention should be given to observing and recording the timing of breeding activity of all the species. In order to interpret the fluctuations in observed densities, it is essential to be able to relate these to the breeding cycles.

The structure of the bird community in the study area

An estimate of the structure of the bird community in the study area for a typical day in October or April follows in Table 2. In all cases, the actual number is expected to be larger than the estimate.

SPECIES ACCOUNTS

The species accounts are arranged in order of decreasing observed abundance. Each account describes the changes in observed density over the study period as well as the regular seasonal fluctuations (if any).

Laughing Dove *Streptopelia senegalensis*

Although the observed densities have decreased since 2006 (Figure 1a), it remained the most abundant species in the area by 2011.

Birds tend to congregate at abundant food sources, especially in gardens where grain and other birdfeed are supplied. Congregations of up to 50 birds were seen. Certain points of concentration were favoured for a number of months and then abandoned. The observed densities varied according to whether the favoured points of concentration fell within the count sites, and therefore the decline in observed densities may not necessarily reflect a decline in the population.

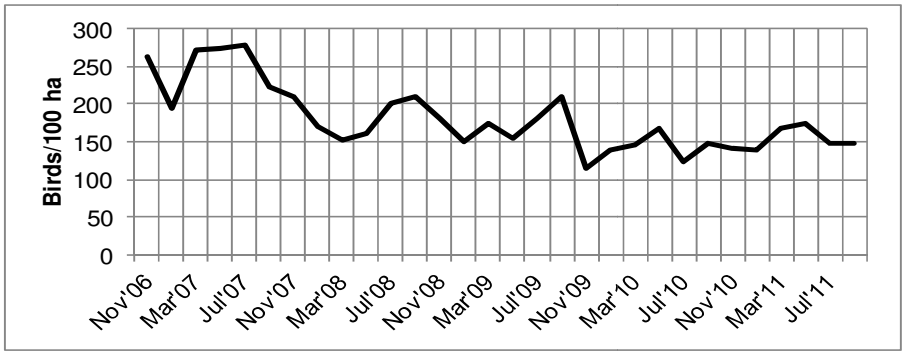

Figure 1a – Laughing Dove, observed densities 2006-2011

Observed densities varied little through the year, with a slight peak in July (200 birds/100 ha) (Figure 1b). This is consistent with breeding throughout the year, as reported for southern Africa (Hockey et al. 2005), and shows no evidence for seasonal movements.

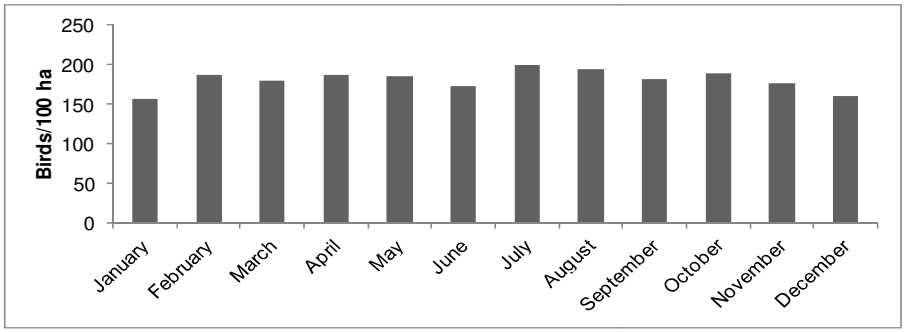

Figure 1b – Laughing Dove, seasonality

Table 2 - An estimate of the composition of the avifauna of Groenkloof on a typical day in April or October

Species	Number of adult birds	Species	Number of adult birds	Species	Number of adult birds	Species	Number of birds
Laughing Dove	180	Thick-billed Weaver	27	Arrow-marked Babbler	9	Pied Crow	2
Rock Dove	153	African Palm Swift	27	Green Wood-Hoopoe	9	Willow Warbler	2
Red-eyed Dove	146	Tawny-flanked Prinia	26	Yellow-fronted Canary	9	White-throated Swallow	2
Dark-capped Bulbul	143	Red Bishop	24	Cut-throat Finch	7	Barn Swallow	1
Karoo Thrush	114	Little Swift	23	African Green-Pigeon	7	Spotted Flycatcher	1
Common Myna	111	European Bee-eater	21	Cape Weaver	6	Kurrichane Thrush	1
Cape Sparrow	97	Streaky-headed Canary	20	Black-backed Puffback	6	Jameson's Firefinch	1
Cape White-eye	92	House Sparrow	18	Black-headed Oriole	6	Bar-throated Apalis	1
Southern Masked Weaver	88	Amethyst Sunbird	18	Rock Martin	5	Woodland Kingfisher	1
Grey Go-away-bird	74	Greater Striped Swallow	18	Cape Wagtail	5	Orange-breasted Bush-Shrike	1
Bronze Mannikin	63	African Olive-Pigeon	15	Grey Hornbill	5	Black-crowned Tchagra	1
Cape Turtle-Dove	57	Fiscal Flycatcher	13	Black-throated Canary	5	Grey-headed Bush-Shrike	1
Hadeda Ibis *	50	Southern Boubou	12	Brown-hooded Kingfisher	4	Long-billed Crombec	1
Speckled Mousebird	45	Village Weaver	12	Paradise Flycatcher	4	Fork-tailed Drongo	1
Speckled Pigeon	40	Crowned Lapwing	12	Burchell's Coucal	4	Groundscraper Thrush	1
Southern Grey-headed Sparrow	37	Red-winged Starling	12	Spotted Thick-knee	3	Red-chested Cuckoo	1
White-bellied Sunbird	34	Cape Glossy Starling	11	Red-throated Wryneck	3	Little Sparrowhawk	1
Cape Robin-Chat	33	African Hoopoe	10	Didric Cuckoo	3	others	5
Crested Barbet	32	White-rumped Swift	10	Common Waxbill	2		
Black-collared Barbet	32	Red-collared Widow	10	Pin-tailed Whydah	2	**Total**	**2,128**
Red-faced Mousebird	28	Common Fiscal	9	Cardinal Woodpecker	2		

* The estimated number for Hadeda Ibis has been adjusted downward relative to the other species on account of its conspicuosness

Rock Dove (Feral Pigeon) *Columba livia*
An alien, introduced from Europe and which has become well established in towns and cities throughout the country. The population appears to have been mostly stable with a peak in observed densities in December 2010 (Figure 2a).

The birds tend to concentrate at the commercial centre (Groenkloof Shopping Centre) (occasionally up to 200 birds) and the bird sanctuary, where they scavenge for bread crumbs and other scraps.

The attitude of human inhabitants to these birds is ambivalent. While some actively feed the birds, landlords of some commercial buildings regard them as pests due to the soiling of rooftops and ledges whether they roost and breed. On some buildings, spikes and other devices are placed on roofs and ledges to discourage the birds. In downtown Pretoria, eggs and chicks are regularly removed from the nests by building maintenance personnel in an attempt to limit their numbers.

Their tendency to dominate smaller birds in private gardens where birds are fed has led to gardeners adopting the use of bird feeders with a low roof to exclude the Rock Doves.

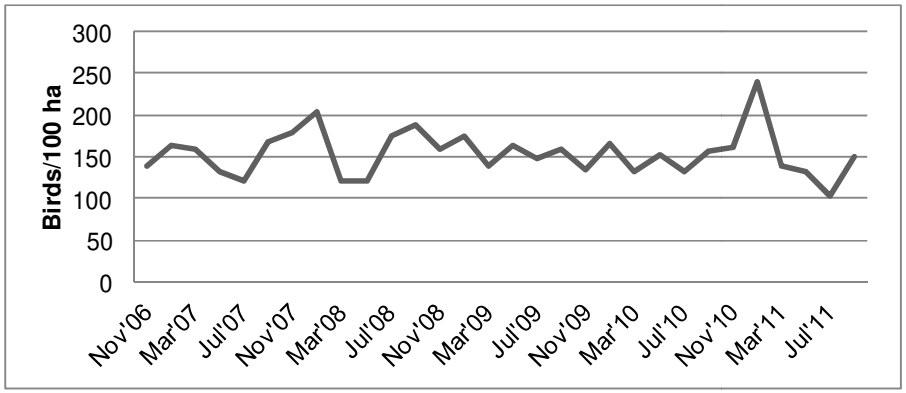

Figure 2a – Rock Dove, observed densities 2006-2011

Breeding may occur throughout the year (Ryan et al. 2005), but the observed peak in densities in mid-summer may reflect a peak in breeding activity at that time. There is no evidence for seasonal movements (Figure 2b), and none are suspected, given their preference for the urban habitat.

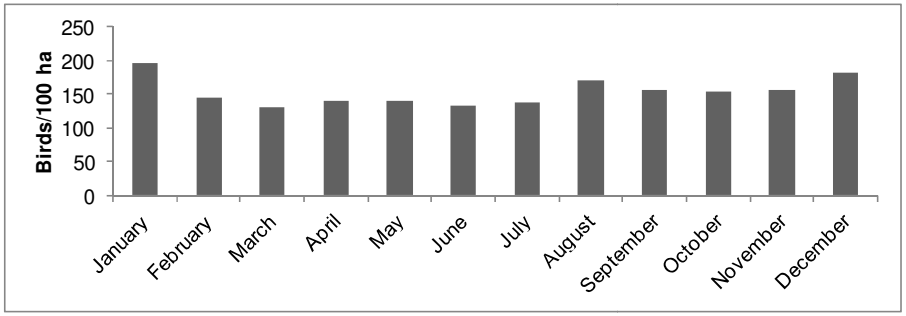

Figure 2b – Rock Dove, seasonality

Red-eyed Dove *Streptopelia semitorquata*
Although observed densities declined throughout the period by up to 30%, it remained among the most abundant species in the area (Figure 3a).

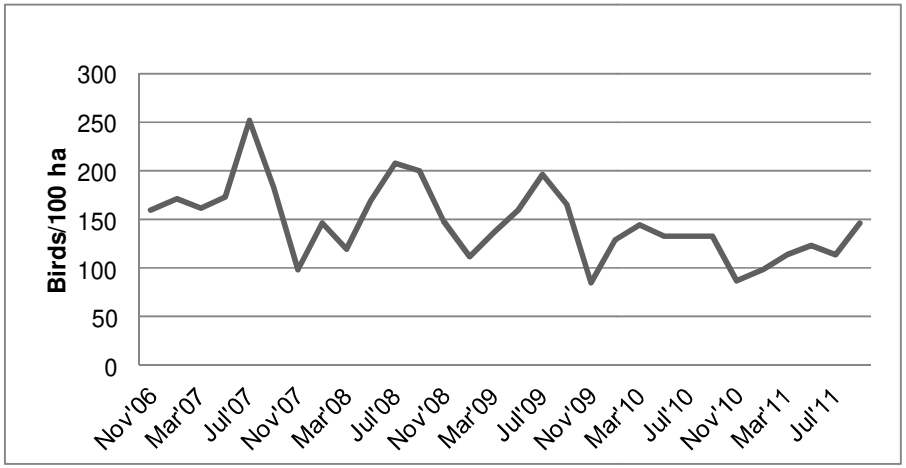

Figure 3a – Red-eyed Dove, observed densities 2006-2011

The observed densities suggest a regular annual cycle with a peak in winter (June to August), followed by a decline to a low in November (Figure 3b).

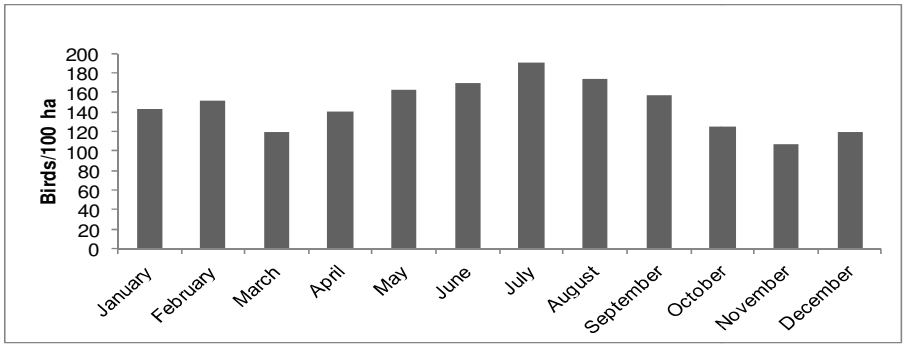

Figure 3b – Red-eyed Dove, seasonality

The increase in observed densities from November to February appears to correspond with the peak of the breeding season, which is mainly from September to January (Hockey et al. 2005). The drop-off in March may reflect mortality of young birds.

During winter, large numbers were sometimes seen flying high overhead. This suggests that some birds make long daily movements between roost sites and foraging grounds, as does the Speckled Pigeon. The birds seen high overhead were not necessarily part of the population which breeds in the study area.

The numbers flying overhead were under-counted because of the difficulty of distinguishing them from Speckled Pigeons at high altitudes. Nevertheless, a significant number of overflying species were positively identified as Red-eyed Doves.

Dark-capped Bulbul *Pycnonotus tricolor*

There appears to be little regularity to the fluctuations in observed densities. There was a peak in March of 2007, but in the four subsequent years, observed densities were relatively low in March (Figure 4a).

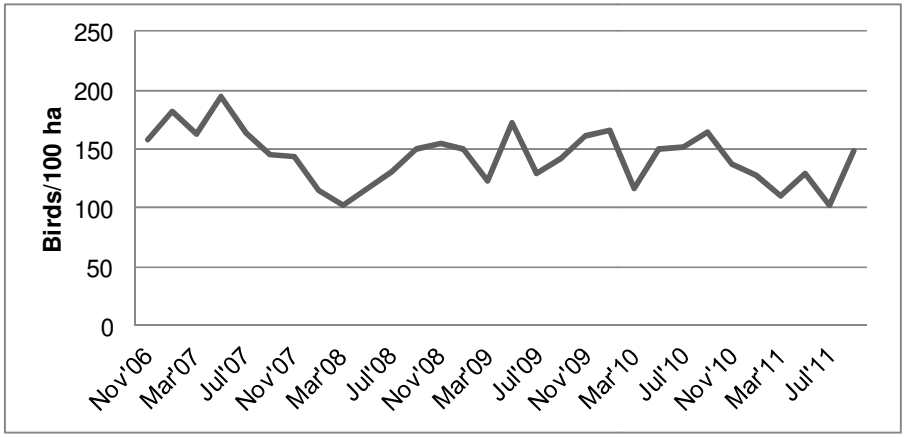

Figure 4a – Dark-capped Bulbul, observed densities 2006-2011

Breeding in South Africa has been reported mainly from September to April, with a peak from October to December (Hockey et al. 2005). The relatively small seasonal fluctuations in observed densities may suggest that breeding here is evenly spread throughout the summer (and possibly throughout the year) (Figure 4b).

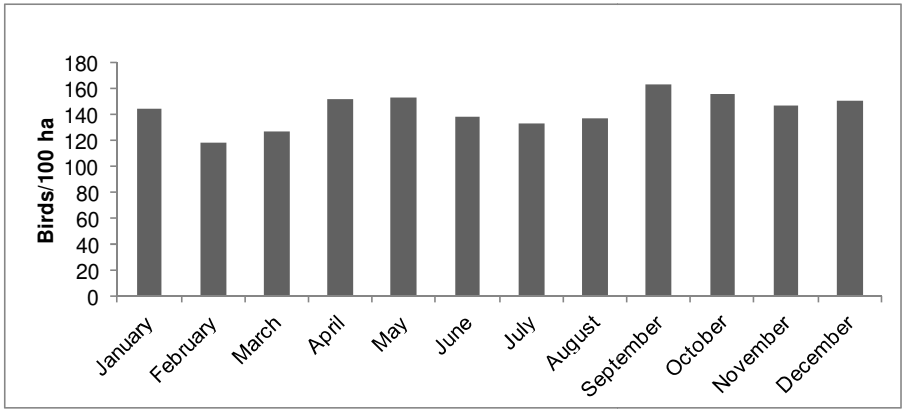

Figure 4b – Dark-capped Bulbul, seasonality

There is no evidence for regular seasonal movements.

Karoo Thrush *Turdus smithi*
The regular cycle of observed densities, peaking in December and reaching a low in July (Figure 5a), supports the hypothesis of a migratory movement by part of the population of the Gauteng highveld (and middleveld) towards the Limpopo Valley (Hockey et al. 2005). Bird atlas data on a regional basis shows a different trend, with lowest reporting rates in February-March (Harrison et al. 2005). The difference in trends suggests that movements are not long range.

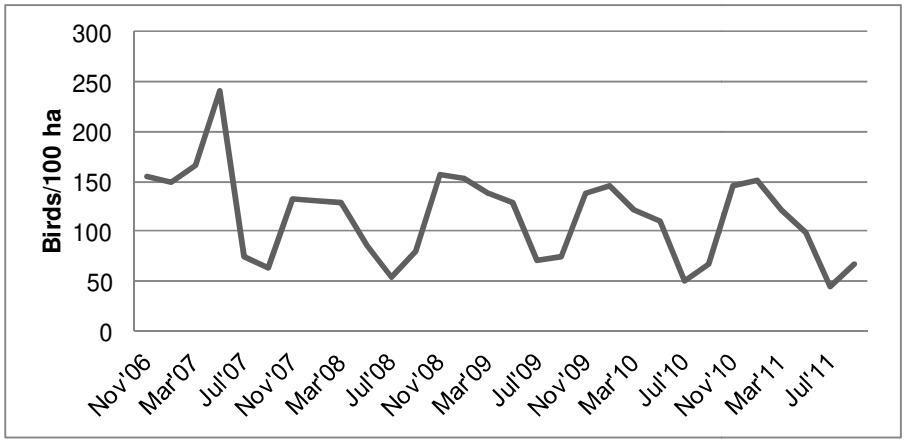

Figure 5a – Karoo Thrush, observed densities 2006-2011

Breeding occurs mostly from October to February (Hockey et al. 2005). The cycle of observed densities corresponds to the breeding season, but the amplitude of the cycle appears to be too large to be explained by breeding and subsequent mortality (the mid-summer numbers are about three times as large as mid-winter numbers) (Figure 5b).

Because Karoo Thrushes are usually seen foraging on the ground, it is not likely that seasonal changes in conspicuousness affect the observed densities.

There was an unusually large influx of birds for a short period in late April and early May of 2007, corresponding with unseasonable cold and wet weather.

Ringing studies have found that, while the birds may appear to be resident in a suburb, there is in fact a high turnover of individuals (Oatley 1998).

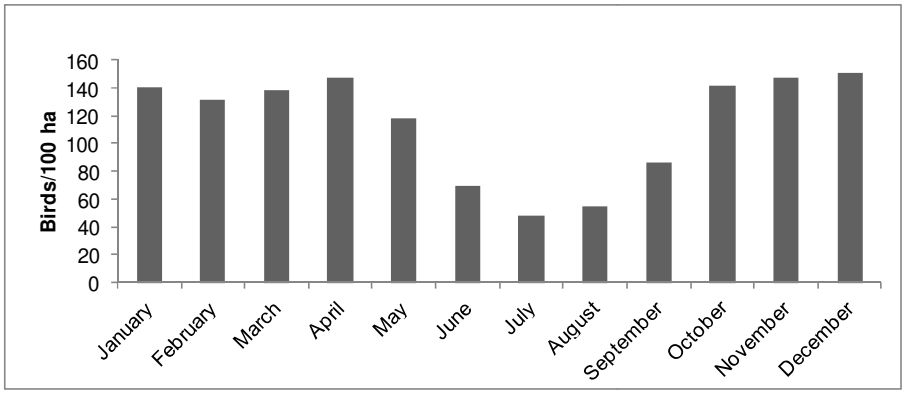

Figure 5b – Karoo Thrush, seasonality

Common Myna *Acridotheres tristis*
An alien species which was introduced to South Africa from Asia. It was first reported in Pretoria in 1955 and became well established here by the 1980s (Hockey et al. 2005).

The population appears to have been stable during the study period. The observed densities showed peaks in March of 2007, 2009, 2010 and 2011, but dropped to a minimum in March of 2008. The atypical pattern of 2008 may reflect poor breeding success in that year (Figure 6a). Van Rensburg et al. (2009) estimated the density of the species in the suburban habitat in Pretoria at 325 birds / 100 ha.

There was little seasonal fluctuation in observed densities, with a slight peak in February and March probably coinciding with the end of the main breeding season (Figure 6b).

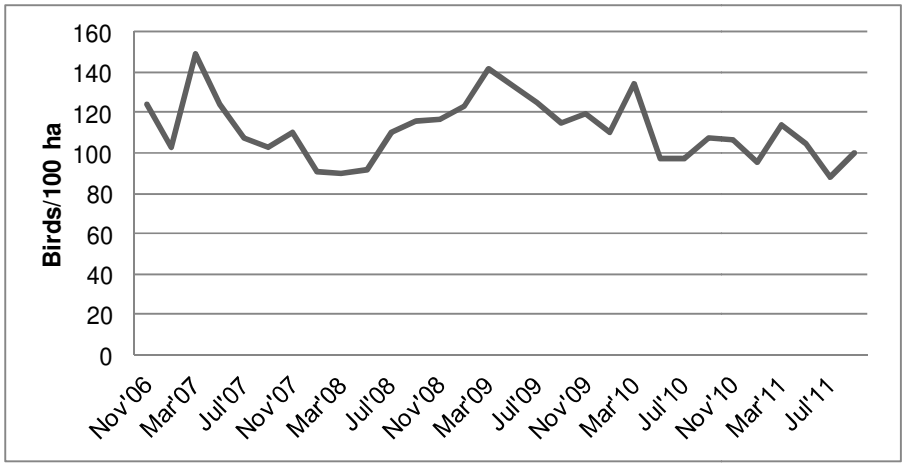

Figure 6a – Common Myna, observed densities 2006-2011

There are unlikely to be any seasonal movements and the lack of seasonality also suggests that there may be a large proportion of non-breeding birds in the population.

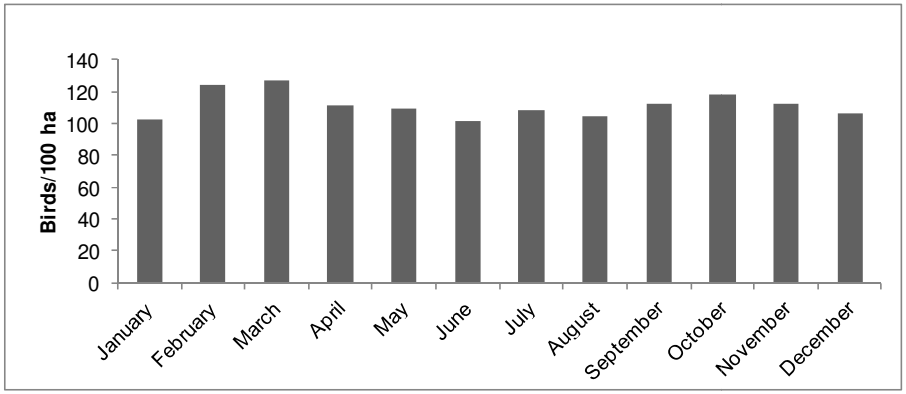

Figure 6b – Common Myna, seasonality

Common Mynas breed under the eaves of buildings as well as in tree-holes. They are suspected of displacing other species within the urban and suburban environment. It is known to attack the young of barbets and hoopoes when contesting the use of suitable nest holes. However, those species remain common in urban areas despite occasional predation by Mynas. In Groenkloof, no species can be identified which has been displaced from the suburban environment by the Common Myna, and there do not seem to be any which are declining as a result of displacement by the Common Myna.

Hadeda Ibis *Bostrychia hagedash*

The Hadeda Ibis has adapted to the suburban environment to the extent that it has become established in towns through much of South Africa, including regions where it did not previously occur. In Pretoria, it was probably scarce to absent before urbanisation took place. It became established in the suburbs in the 1980s (or possibly earlier) and rapidly increased in numbers to become among the most abundant species in that environment. By 2006, the population appears to have stabilised, and did not increase further during the study period (Figure 7a).

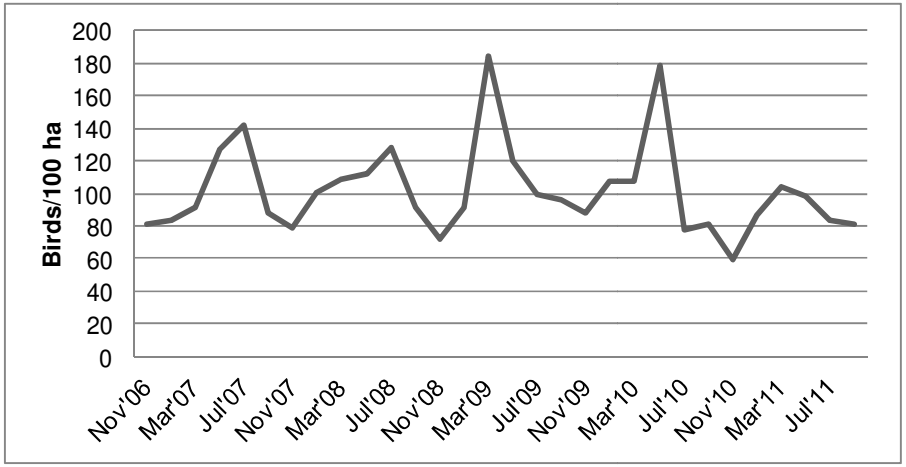

Figure 7a – Hadeda Ibis, observed densities 2006-2011

There were spikes in the observed densities in April 2007, May to July 2008, March 2009, April 2010 and April 2011. These spikes follow the breeding season (egg-laying occurs mainly September to November (Hockey et al. 2005)) and represent increased numbers of

non-breeding birds roosting communally at the Austin Roberts bird sanctuary (Figure 7b).

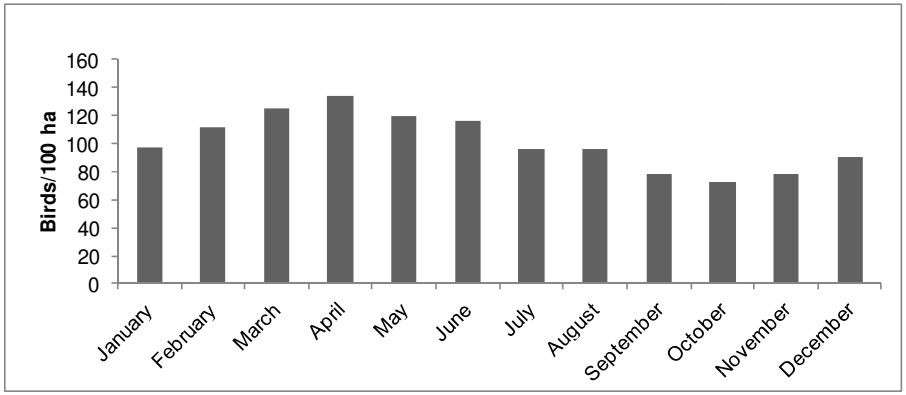

Figure 7b – Hadeda Ibis, seasonality

The birds are dispersed throughout the area when not roosting communally. Bird atlas data showed a different trend on a regional level, with highest reporting rates in September-October and lowest in March to May (Harrison et al. 1997). The difference in trends indicates that the trend observed here represents a local effect.

Cape Sparrow *Passer melanurus*

The fluctuations in observed densities show little regularity, other than to peak in mid-winter of each year (Figure 8a).

Breeding takes place throughout the summer (Hockey et al. 2005), and therefore the mid-winter peak in observed densities is unexpected (Figure 8b). It may be explained by a tendency to congregate on the ground at food sources during winter, making the birds more conspicuous. Its preference for the suburban environment and the habit of building and using roosting nests in winter suggest that it is sedentary.

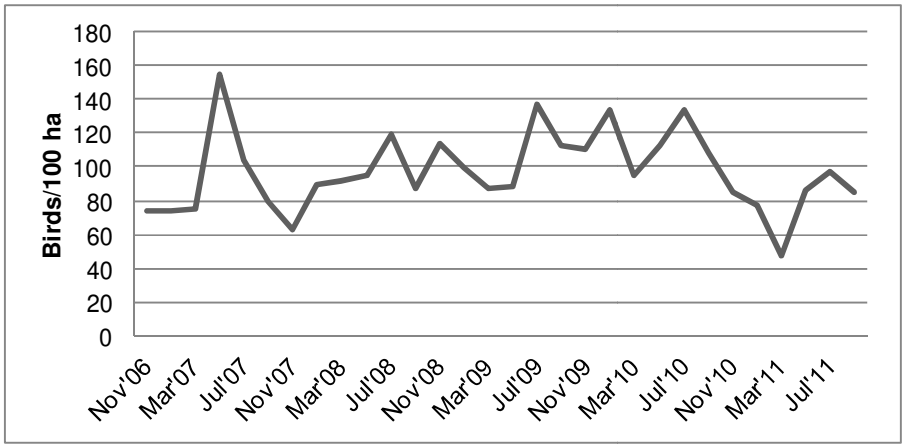

Figure 8a – Cape Sparrow, observed densities 2006-2011

It appears to be more common in the younger suburbs of Pretoria than in Groenkloof (F Peacock, pers. comm.).

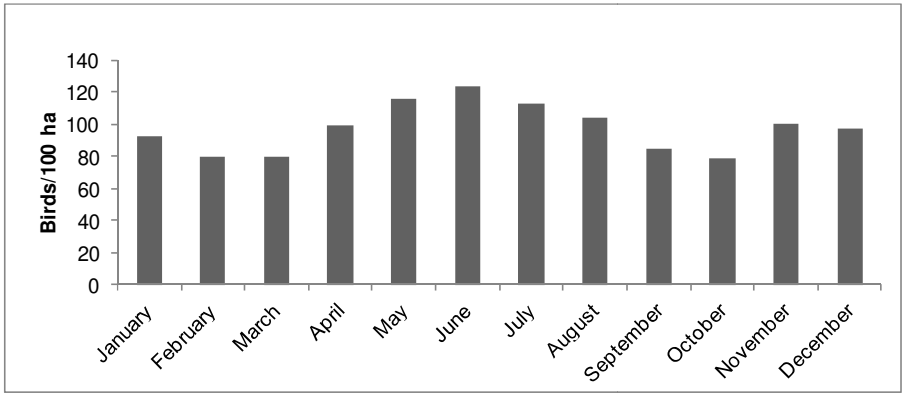

Figure 8b – Cape Sparrow, seasonality

Cape White-eye *Zosterops virens*

Despite large annual fluctuations in observed density, the overall population does not appear to have changed (Figure 9a).

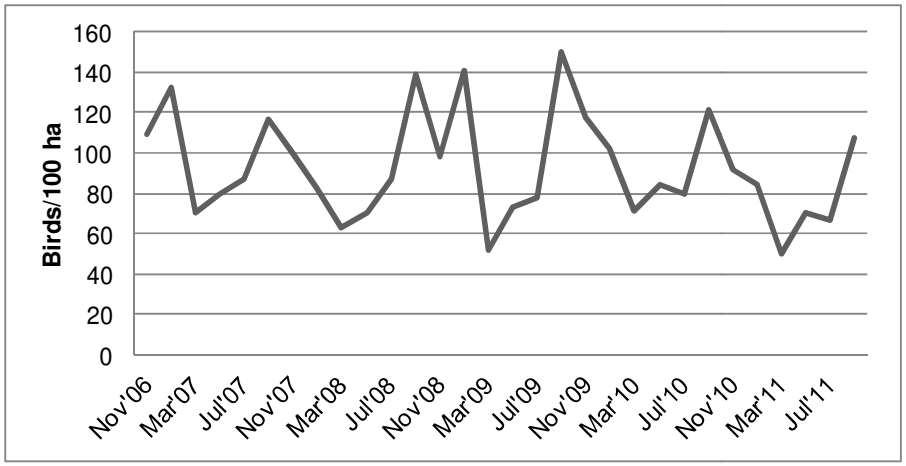

Figure 9a – Cape White-eye, observed densities 2006-2011

The seasonal fluctuations in observed density may be largely influenced by changes in conspicuousness (Figure 9b). During the summer, birds are generally seen in pairs or groups of not more than four birds, whereas in late winter they are sometimes seen in flocks of up to 50 birds, significantly increasing their conspicuousness. In addition, the winter loss of foliage by deciduous trees and shrubs increases the conspicuousness of birds which mostly forage within the canopy.

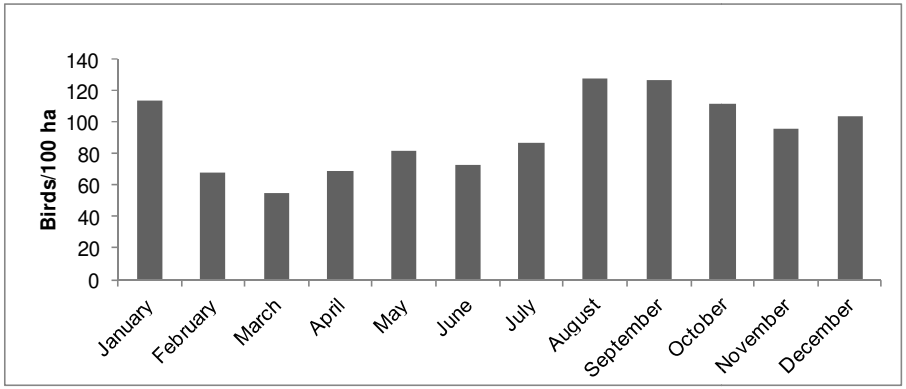

Figure 9b – Cape White-eye, seasonality

Bird atlas data on a regional scale show lowest reporting rates in February to April (Harrison et al. 1997).

The increase in observed densities in January follows the breeding season (egg-laying occurs from October to December (Hockey et al. 2005)).

Southern Masked-Weaver *Ploceus velatus*

For this species, seasonal changes in conspicuousness are a significant factor affecting observed densities (Figure 10a). Not only does the brilliant breeding plumage make males more conspicuous in the breeding season, but nest-building activity further increases their conspicuousness.

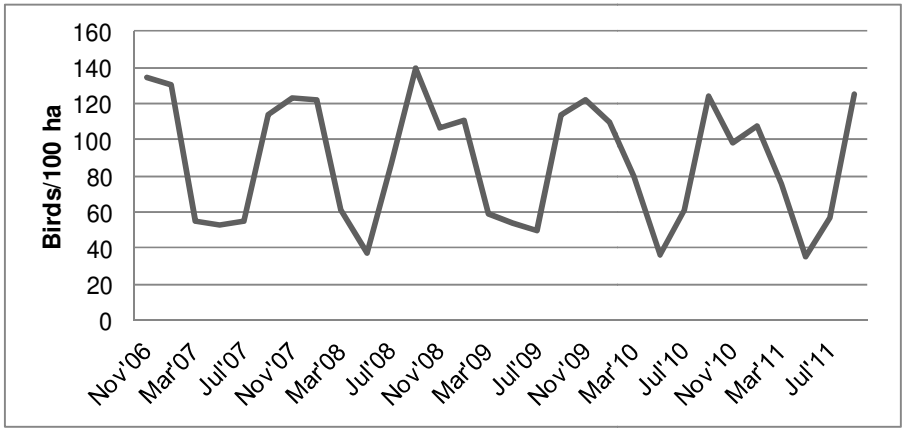

Figure 10a – Southern Masked-Weaver, observed densities 2006-2011

During the non-breeding season, birds disperse from their breeding territories and are seen in small flocks throughout the area (Figure 10b). Bird atlas data on a regional scale show the same seasonal trend for reporting rates (Harrison et al. 2007).

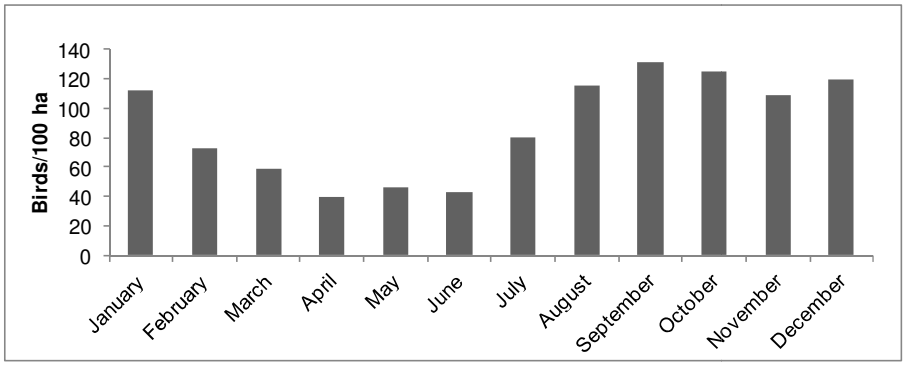

Figure 10b – Southern Masked-Weaver, seasonality

Breeding was observed from July to February.

Grey Go-away-bird *Corythaixoides concolor*
Since the 1980s, the species has increased its range by adapting to the suburban environment. In Gauteng Province, it invaded urban areas where it had not previously occurred. It probably always occurred around the outskirts of Pretoria, but has recently invaded the suburbs and is probably more numerous there now than it was before urbanisation. There appears to have been a decline in the population during the study period of up to 50%, but it remains among the most abundant species here (Figure 11a).

There was a sharp peak in mid-winter of each year, suggesting there may be an influx (Figure 11b), but bird atlas data on a regional scale show the same seasonal pattern for reporting rates (Harrison et al. 1997), indicating that the trend is not a local phenomenon. Changes in conspicuousness are not likely to be a factor because it is highly conspicuous at all times. Long-range seasonal movements are not suspected.

Breeding may occur throughout the year, but mainly September to October (Hockey et al. 2005).

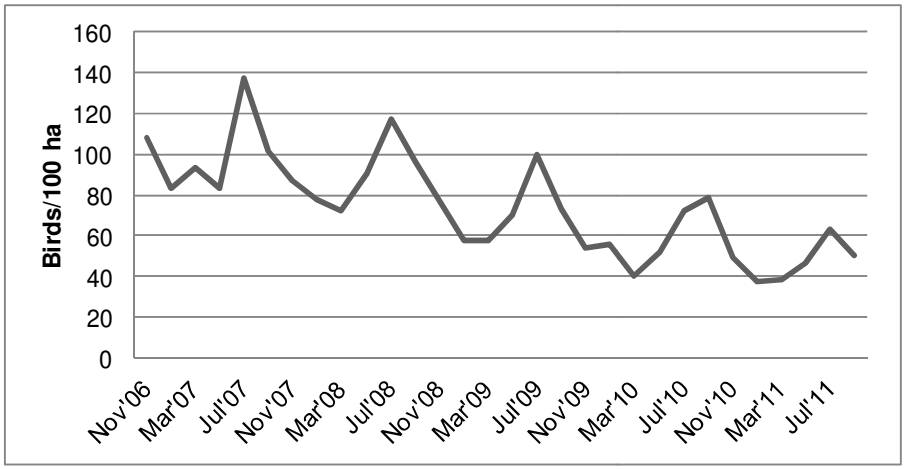

Figure 11a – Grey Go-away-bird, observed densities 2006-2011

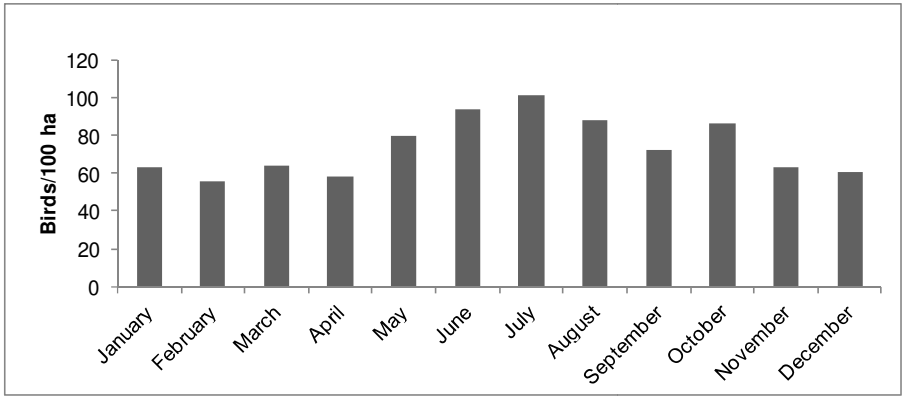

Figure 11b – Grey Go-away-bird, seasonality

Bronze Mannikin *Spermestes cucullatus*
The Bronze Mannikin is believed to have increased in suburban areas due to adaptation to the suburban environment (Hockey et al. 2005). The population in Groenkloof appears to have been stable during the study period (Figure 12a).

In summer, they were usually seen in family groups of six to ten birds. In winter (April to October), they were often seen in bigger flocks (up to 40 birds).

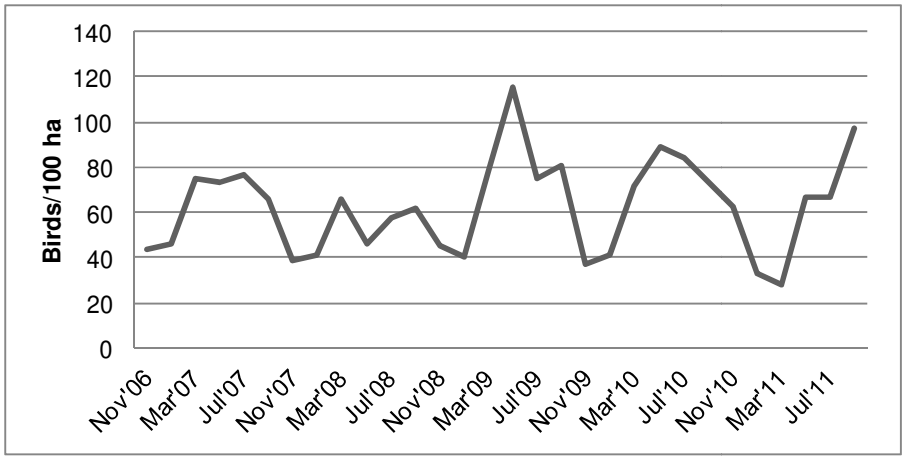

Figure 12a – Bronze Mannikin, observed densities 2006-2011

Breeding occurs mainly from December to April (Hockey et al. 2005).

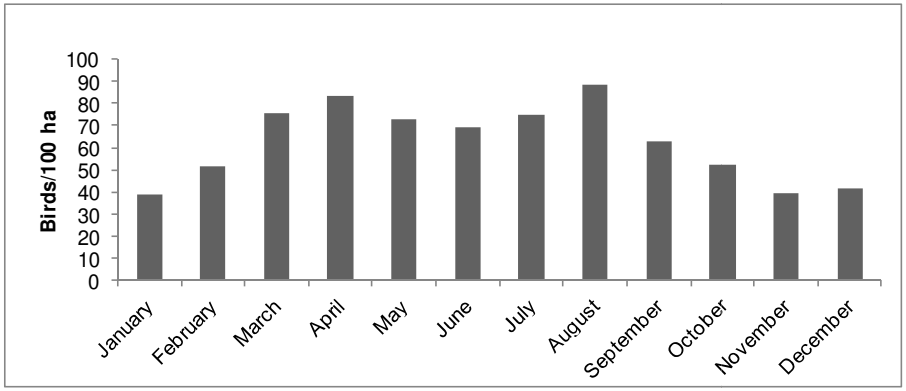

Figure 12b – Bronze Mannikin, seasonality

Seasonal movements are not suspected and the fluctuations in observed densities may be due to changes in conspicuousness related to seasonal changes in behaviour (Figure 12b). Due to the small size of the birds, flocking greatly increases their conspicuousness. They become less conspicuous when they pair off to breed.

Cape Turtle-dove *Streptopelia capensis*

It is difficult to detect any regularity in the fluctuations in observed densities for this species. The population may have increased from 2006 to 2007, but has otherwise remained stable (Figure 13a).

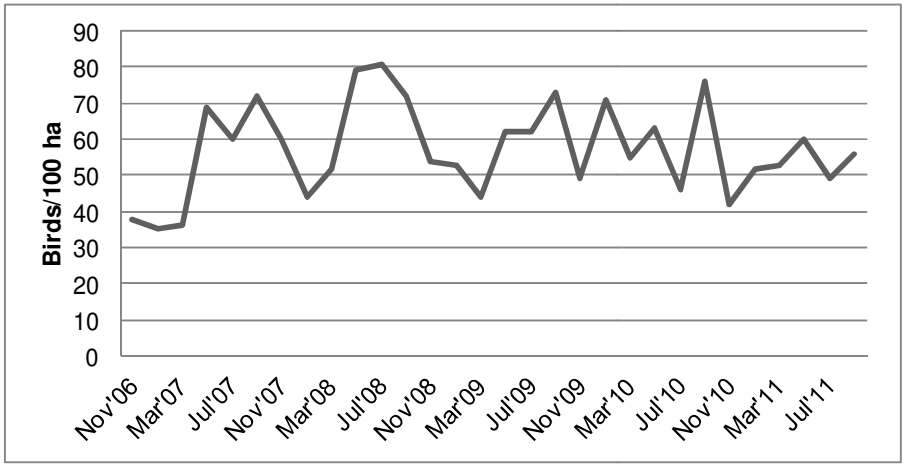

Figure 13a – Cape Turtle-dove, observed densities 2006-2011

Egg-laying in the summer-rainfall region of South Africa occurs mainly from August to November and February to June (Hockey et al. 2005). The pattern of seasonality does show two peaks in observed densities (Figure 13b). If the peaks represent a population increase after breeding, then we would deduce that the egg-laying peaks may be in March and July. However, the peaks in observed densities could alternatively be due to increased conspicuousness resulting from increased calling frequency.

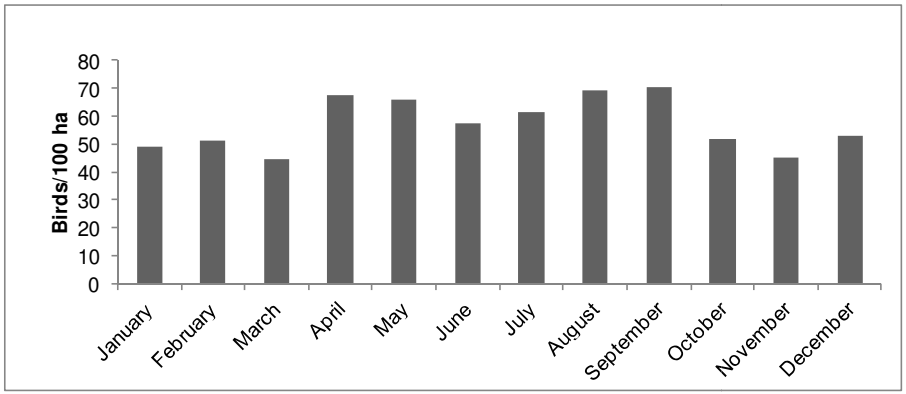

Figure 13b – Cape Turtle-dove, seasonality

Speckled Mousebird *Colius striatus*
The upward trend in observed densities indicates that the population may be increasing (Figure 14a).

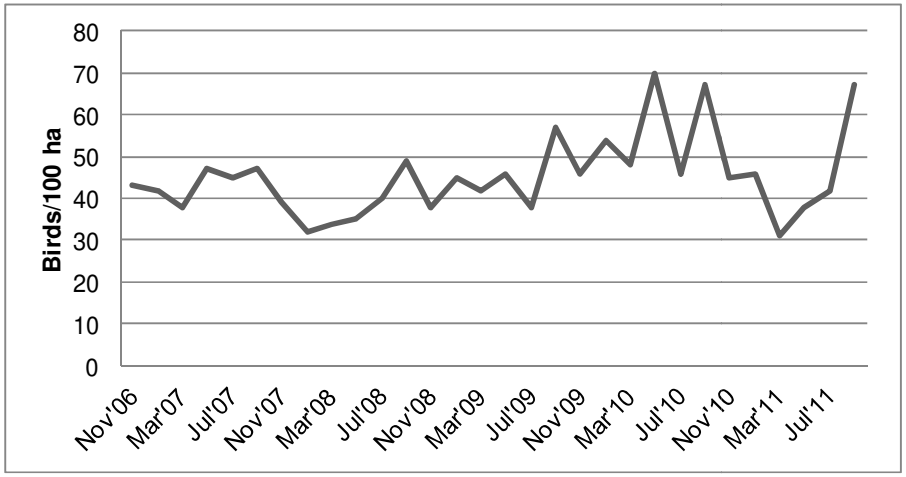

Figure 14a – Speckled Mousebird, observed densities 2006-2011

Birds were usually seen in family groups of four to eight birds. The groups were not very cohesive, and individuals sometimes appeared to be separated from the group. The birds sometimes roost in a tight bunch, and on one occasion such a bunch was seen to include at least one Red-faced Mousebird as well as Speckled Mousebirds.

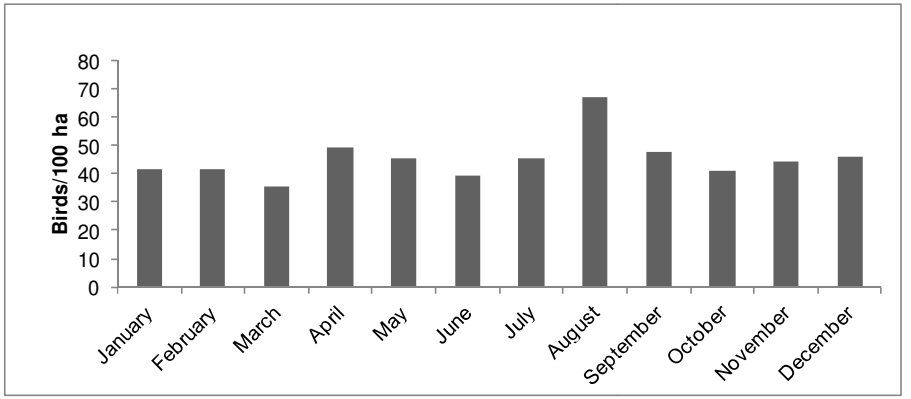

Figure 14b – Speckled Mousebird, seasonality

Egg-laying in southern Africa is mainly from September to January (Hockey et al. 2005). The observed densities peaked in August and showed a drop in March of each year (Figure 14b). It is not clear how the fluctuations in observed densities relate to the breeding cycle, if at all. The possibility of an influx in August cannot be ruled out.

Speckled Pigeon *Columba guinea*
There appears to have been a dramatic increase in the population during the study period, coinciding with increased use of roofs of residential buildings for roosting and breeding (Figure 15a).

Interpretation of seasonal fluctuations of observed densities is complicated by daily movements (Figure 15b). The species is known to make long daily movements from roost sites to foraging grounds (Hockey et al. 2005). Particularly in winter, large numbers are seen passing by high overhead. It is likely that most of the overflying birds are not part of the population which breeds in the study area. Counts of the overflying birds were not accurate because they were often at a height where positive identification was difficult.

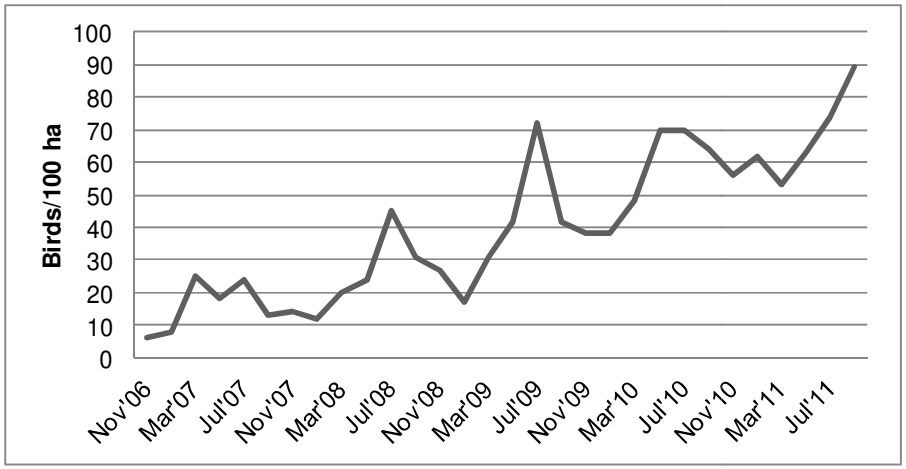

Figure 15a – Speckled Pigeon, observed densities 2006-2011

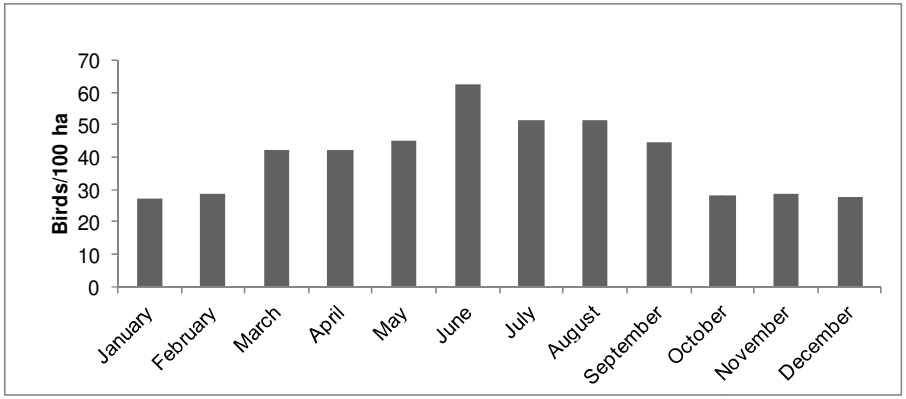

Figure 15b – Speckled Pigeon, seasonality

Breeding in southern Africa has been reported throughout the year (Hockey et al. 2005). Breeding here was observed in early summer (October to December).

Southern Grey-headed Sparrow *Passer diffusus*

The observed densities show a steady increase throughout the study period, indicating that the Groenkloof population is increasing (Figure 16a). It is believed to have extended its range in other parts of South Africa in recent years.

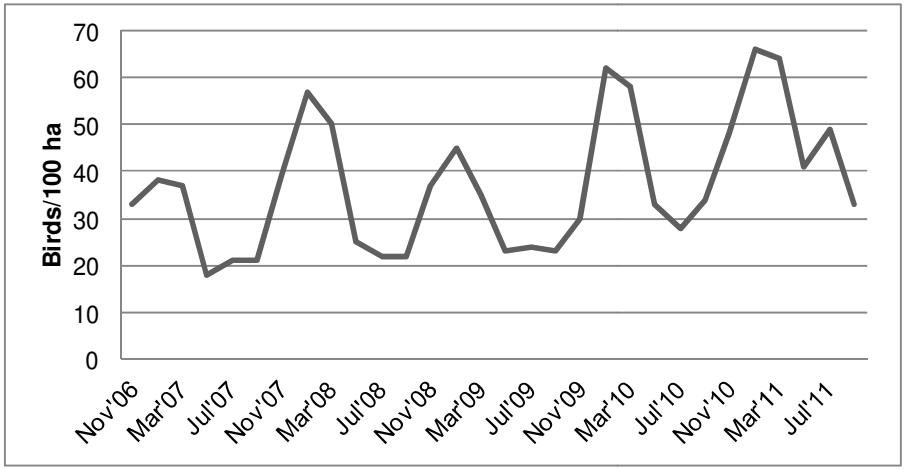

Figure 16a – Southern Grey-headed Sparrow, observed densities 2006-2011

Breeding was observed in the summer months, coinciding with a strong peak in observed densities (Figure 16b). All of the observed nests were placed inside the hollow crossbeams of the electricity pylons along the streets of Groenkloof. This means that the birds were particularly conspicuous when entering and leaving the nests. Increased conspicuousness and recruitment of newly fledged young into the population in summer probably explains the pattern of seasonality in observed densities, and there is no evidence for seasonal movements.

It is not known whether the use of pylons for nesting is a recent adaptation. If so, it may explain the apparent population increase.

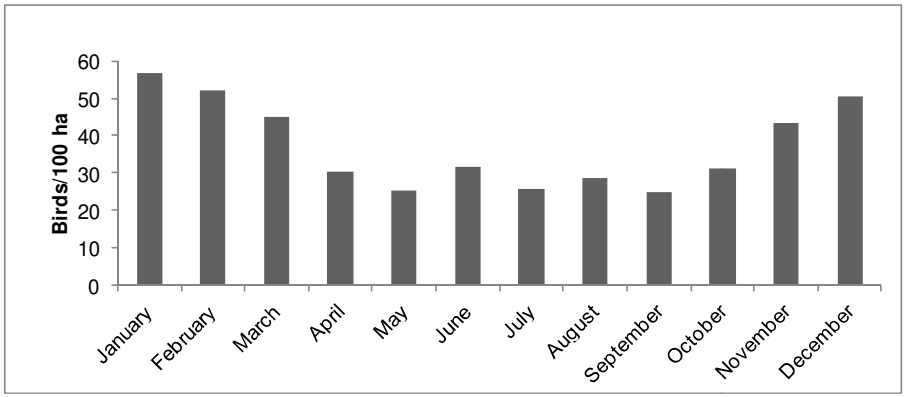

Figure 16b – Southern Grey-headed Sparrow, seasonality

White-bellied Sunbird *Cinnyris talatala*

The population appears to have been stable during the study period, with larger fluctuations in observed densities during the later years (2009 to 2011) than in 2007, 2008 (Figure 17a).

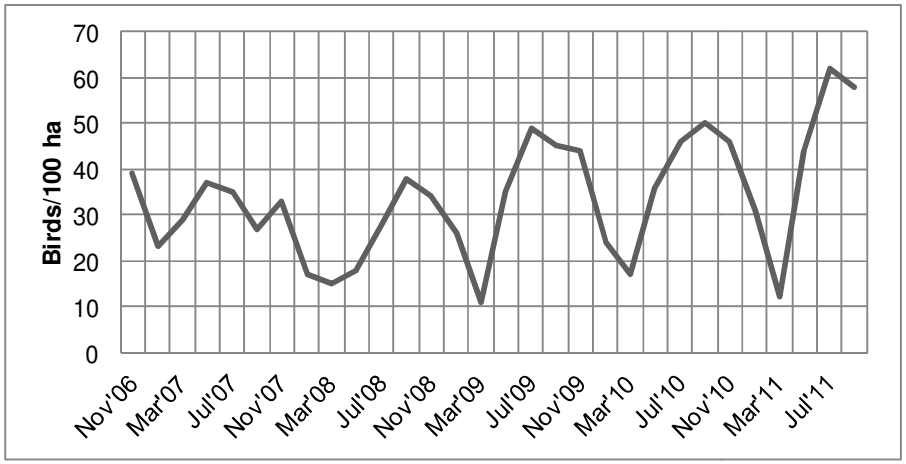

Figure 17a – White-bellied Sunbird, observed densities 2006-2011

The pattern of seasonality in observed densities may be strongly influenced by changes in behaviour (Figure 17b). The greatest numbers are observed when the birds cluster around certain flowering plants. The annual peak in observed densities moves between April and September, while the trough is fairly consistently in March (except in 2007 when it was earlier).

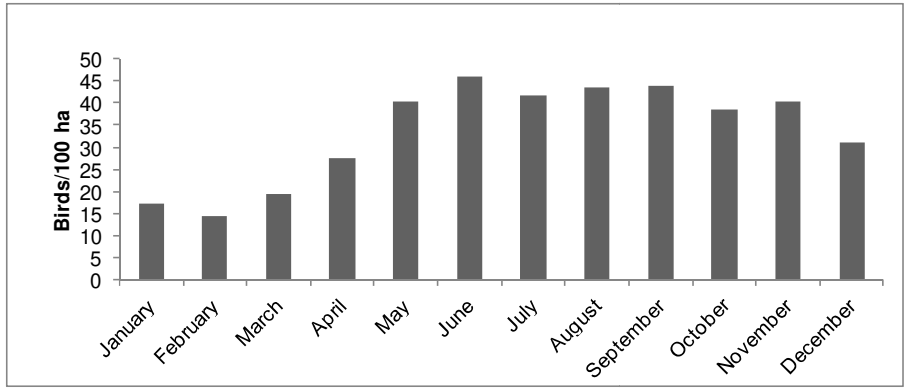

Figure 17b – White-bellied Sunbird, seasonality

Seasonal movements within southern Africa are strongly suspected but not well described (Hockey et al. 2005). There may well be an exodus from Groenkloof in late summer (January to March). Bird atlas data on a regional scale show a large drop in reporting rates during January to March throughout the eastern half of southern Africa (Harrison et al. 1997). Breeding in southern Africa is mainly from July to April (Hockey et al. 2005).

Cape Robin-Chat *Cossypha caffra*

The population appears to have increased by as much as 50% during the study period (Figure 18a).

Because this is a skulking species which may be more often heard than seen, the seasonal fluctuations in observed densities are expected to be influenced by calling frequency. The peak from August to November may reflect a peak in calling activity during the breeding season (Figure 18b) (egg-laying in this region occurs mainly from August to October (Hockey et al. 2005)), and the lesser

peak from March to May may reflect the presence of newly fledged young.

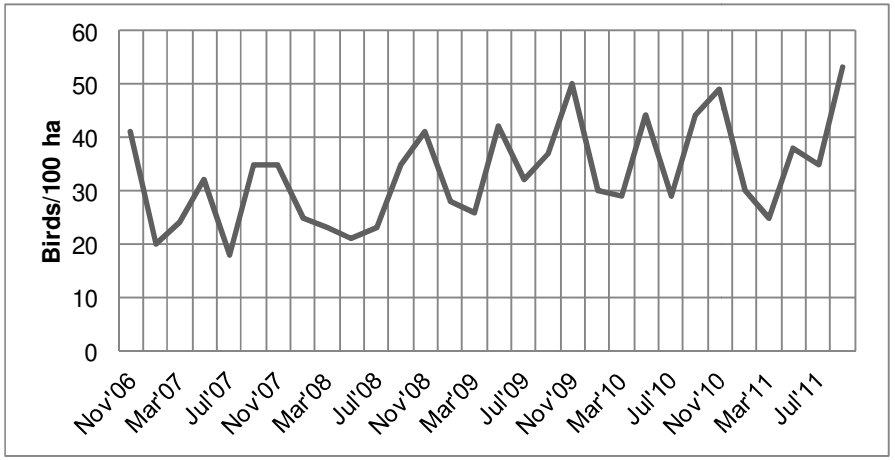

Figure 18a – Cape Robin-Chat, observed densities 2006-2011

It is known to be an altitudinal migrant in parts of its range, moving from high altitudes in winter towards the east coast of southern Africa (Hockey et al. 2005). The mid-winter drop in observed densities here is more likely to reflect lower calling frequency than seasonal movements.

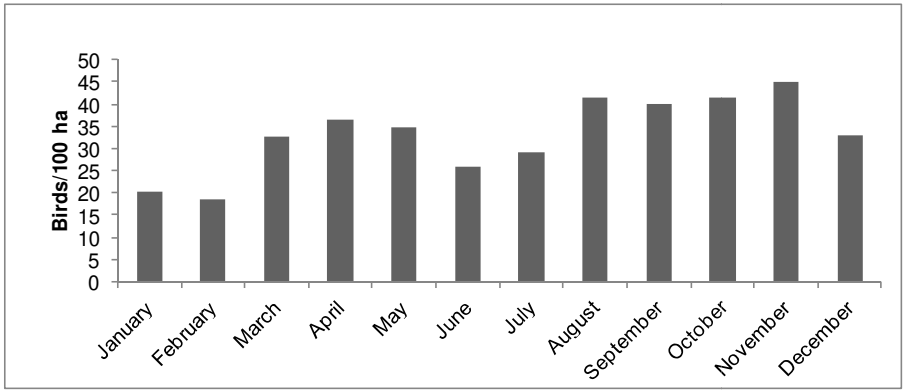

Figure 18b – Cape Robin-Chat, seasonality

Crested Barbet *Trachyphonus vaillantii*

The species has expanded its range in South Africa by adapting to the suburban environment. In Pretoria, it was well established in the suburbs before the study period and the population appeared to have been stable during the study period (Figure 19a).

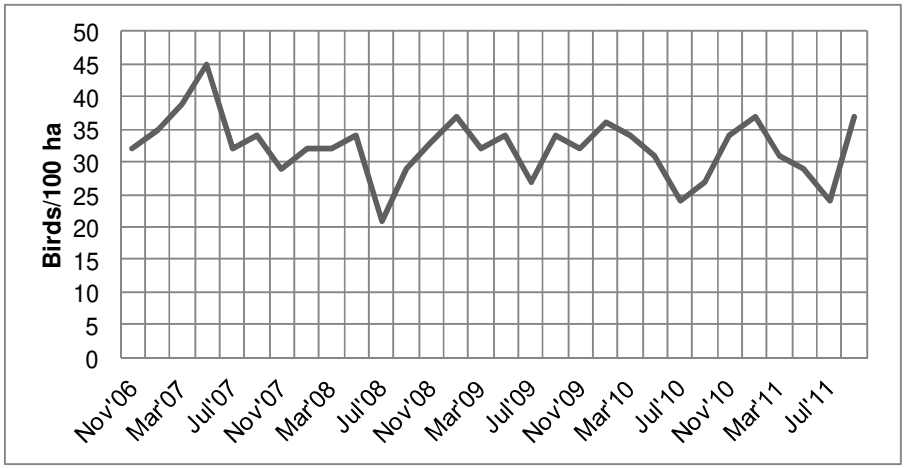

Figure 19a – Crested Barbet, observed densities 2006-2011

Breeding in South Africa has been recorded throughout the year with a peak from October to February (Hockey et al. 2005). Although not inconspicuous to begin with, its loud and characteristic calls add to its conspicuousness. The dip in observed densities in mid-winter therefore probably reflects a drop in calling frequency, and seasonal movements are not suspected (Figure 19b).

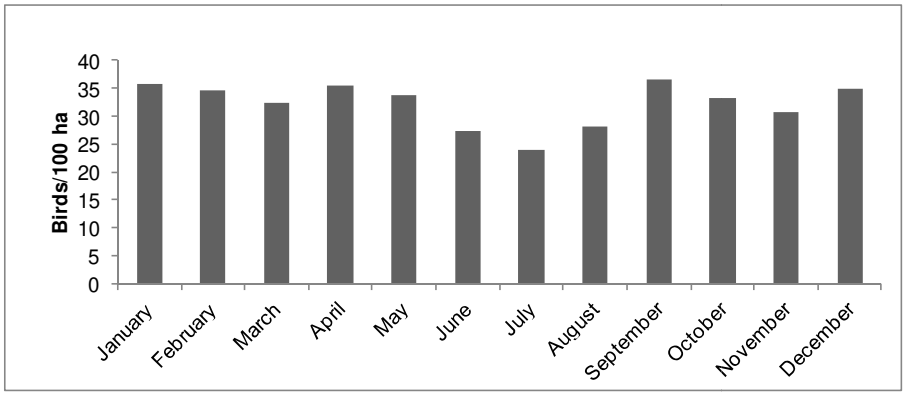

Figure 19b – Crested Barbet, seasonality

Black-collared Barbet *Lybius torquatus*

The observed densities suggest that there may have been an increase in the population over the study period (Figure 20a). The provision of nesting logs by gardeners in the suburbs has become popular and this may have contributed to population growth.

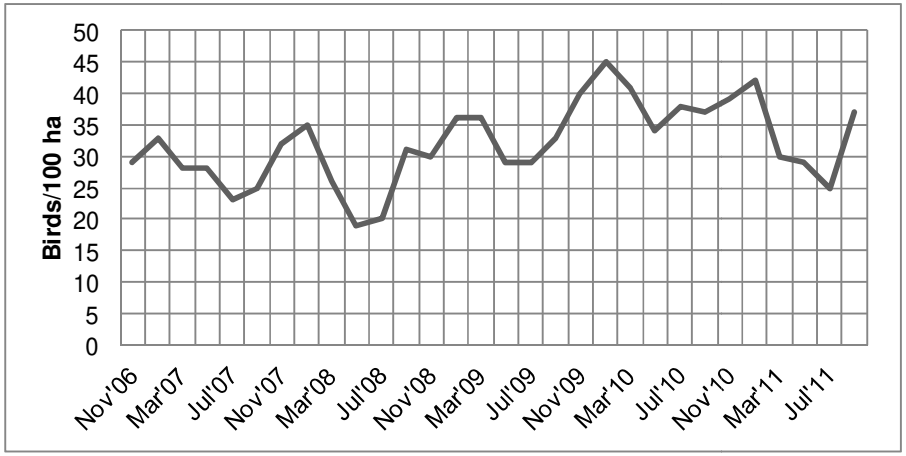

Figure 20a – Black-collared Barbet, observed densities 2006-2011

The seasonal fluctuations in observed densities are consistent with the breeding season. The summer peaks and winter troughs probably reflect both increased calling frequency and recruitment of fledglings into the population during summer (Figure 20b). No seasonal movements are suspected.

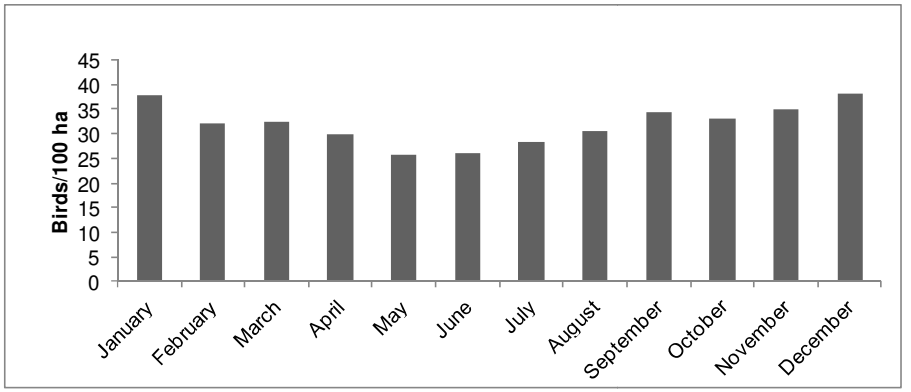

Figure 20b – Black-collared Barbet, seasonality

Egg-laying takes place mainly from October to December (Hockey et al. 2005).

Red-faced Mousebird *Urocolius indicus*

The Red-faced Mousebird appears to be nomadic on a local scale. It was seen in family groups of four to ten birds. The groups are more cohesive than is the case for the Speckled Mousebird, and individuals were seldom seen in isolation. When in flight, the groups usually stayed together in close formation.

There was high volatility in the observed densities, but no discernable seasonal pattern to the variations. There were sharp peaks in observed numbers in April of 2007 and of 2009, but no increase or even a decrease in April of the other years. During August of 2011, no birds at all could be found within the study area, but several groups were present from 1 September onwards (Figure 21a). Although it fell outside of the study period, a similar absence was noted in August of 2006.

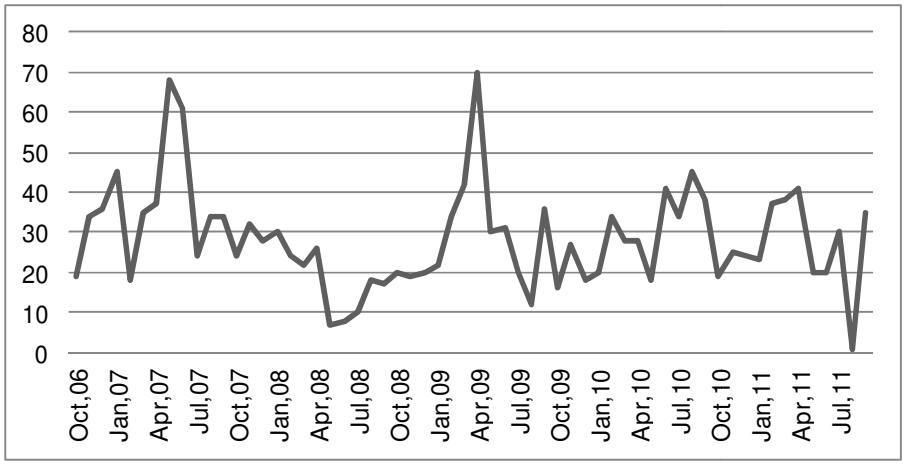

Figure 21a – Red-faced Mousebird, observed densities 2006-2011

The Red-faced Mousebird is an altitudinal migrant in parts of southern Africa, moving to lower altitudes from the high Drakensburg in winter (Hockey et al. 2005). No regular seasonal movements are suspected here, but frequent movements over short distances are likely (Figure 21b). Breeding occurs from July to February (Hockey et al. 2005).

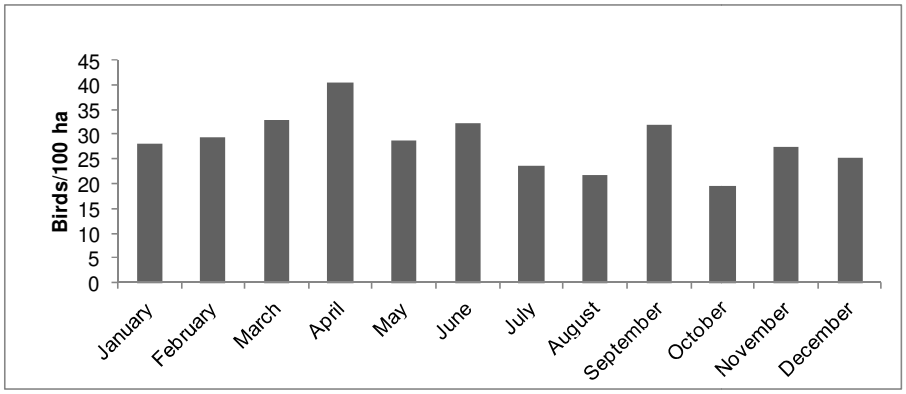

Figure 21b – Red-faced Mousebird, seasonality

Thick-billed Weaver *Amblyiospiza albifrons*

The species has expanded its range westward in South Africa in recent years. However, the Groenkloof population has probably been present for more than 40 years (Tarboton et al. 1987) and appeared stable during the study period (Figure 22a). Breeding took place in reeds in the wetlands of the Austin Roberts Bird Sanctuary. Breeding attempts by at least two pairs were also observed in trees overhanging ponds at the Cilliers Park.

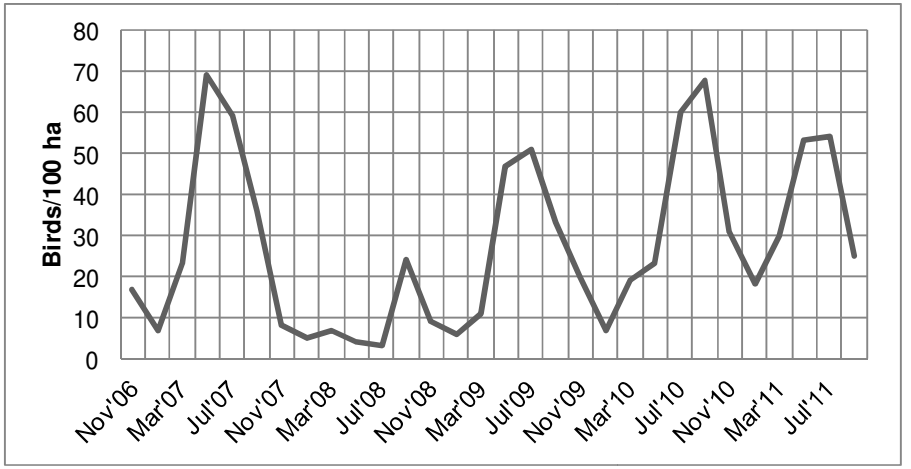

Figure 22a – Thick-billed Weaver, observed densities 2006-2011

During winter, flocks (sometimes of more than 50 birds) were seen leaving the reeds in the Bird Sanctuary in the morning and returning in the evening. Smaller groups were seen foraging around the suburb during the day. During the summer, when breeding occurred, fewer birds were present. The Bird Sanctuary is apparently a winter roost for birds from farther afield. The winter peak is more pronounced in some years than others, with minimum numbers in 2008 (Figure 22b).

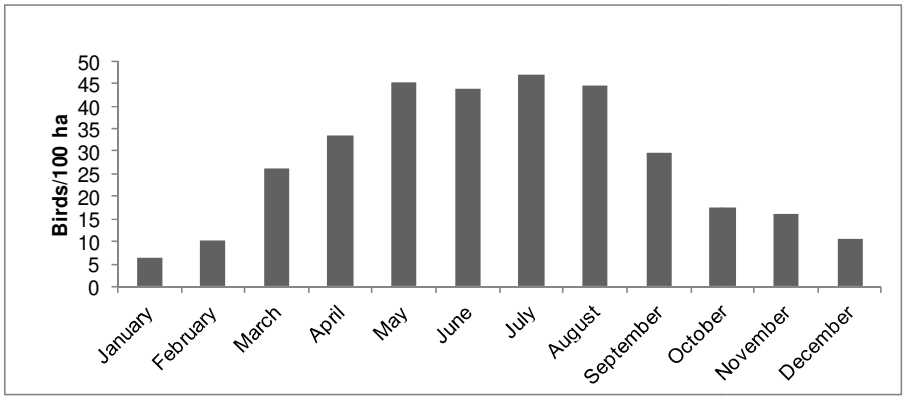

Figure 22b – Thick-billed Weaver, seasonality

African Palm-Swift *Cypsiurus parvus*

Within southern Africa, the species was previously confined to the north east coast due to its dependence on palm trees for breeding and roosting. It spread into South Africa after 1940 and suburban areas of the interior, including Groenkloof by 1955 (Hockey et al. 2005), as a result of the proliferation of alien palm species in gardens. At the time of this study, the Groenkloof population was long established and stable (Figure 23a).

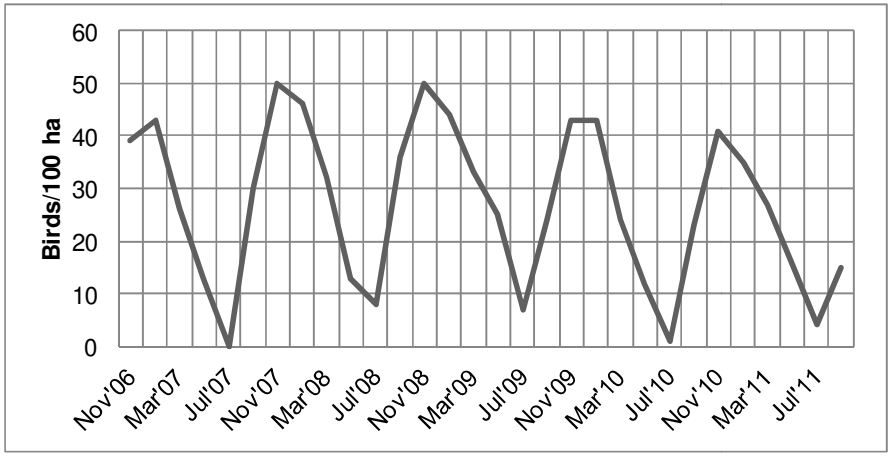

Figure 23a – African Palm-Swift, observed densities 2006-2011

Although there is strong seasonality in the observed densities, at least some birds were present throughout the winter (Figure 23b). It is possible that the birds escape detection during winter by foraging at high altitudes (as is the case with the Little Swift). A winter exodus is therefore not certain, but possible. It is not migratory within its historical range and may be subject to high winter mortality in the colder parts of its expanded range (Harrison et al. 1997).

Egg-laying records for South Africa are mostly from August to October (Hockey et al. 2005).

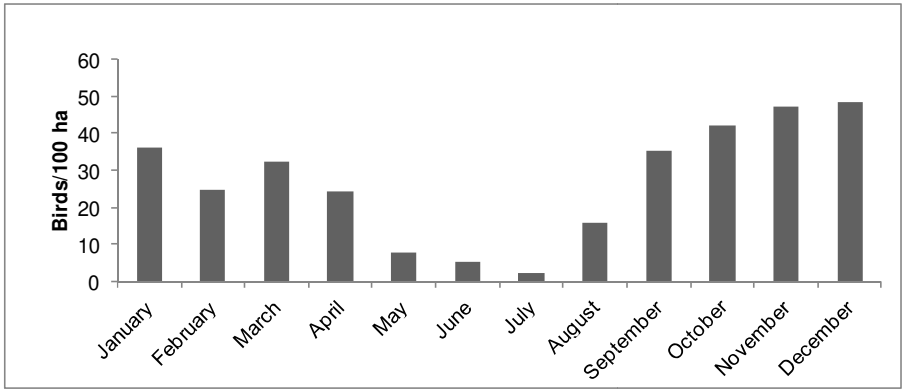

Figure 23b – African Palm-Swift, seasonality

Tawny-flanked Prinia *Prinia subflava*

The population appears to have increased during the study period (Figure 24a). During 2006 to 2009, birds were encountered only at the Austin Roberts Bird Sanctuary and at the two public parks within the study area. During the later period (2010 to 2011), birds were also occasionally encountered among private gardens.

Egg-laying in the region has been reported mainly from November to February (Hockey et al. 2005). The pattern of seasonality may reflect the fact that the species is most vocal and conspicuous during the breeding season (Figure 24b).

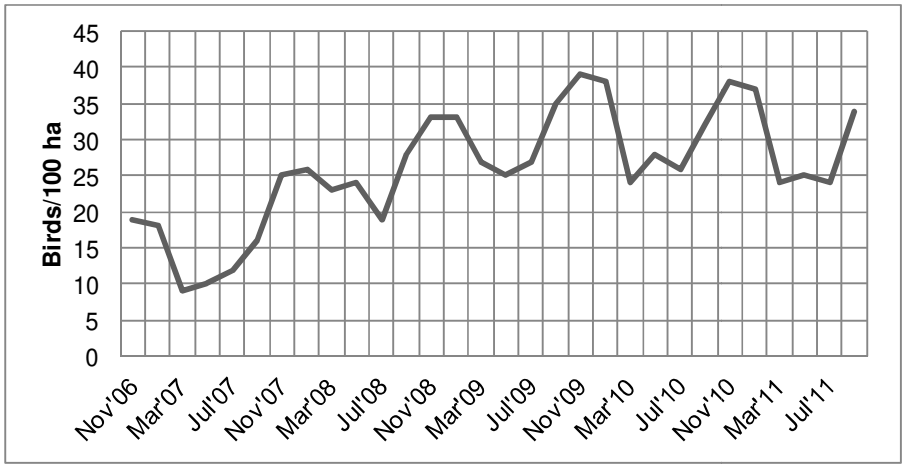

Figure 24a – Tawny-flanked Prinia, observed densities 2006-2011

The species is thought to be an altitudinal migrant from high altitudes in the Drakensberg range (Hockey et al. 2005), but seasonal movements are not suspected here.

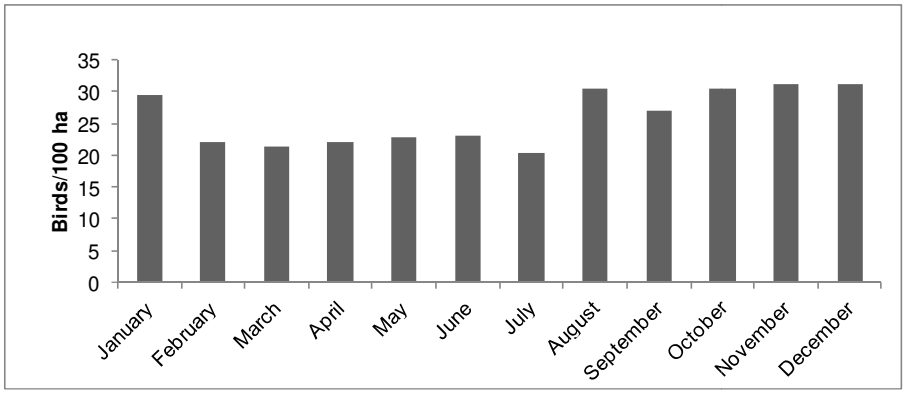

Figure 24b – Tawny-flanked Prinia, seasonality

Southern Red Bishop *Euplectes orix*

The Southern Red Bishop breeds in reed-beds at the Austin Roberts Bird Sanctuary, and disperses throughout the study area and further afield when not breeding (Figure 25a).

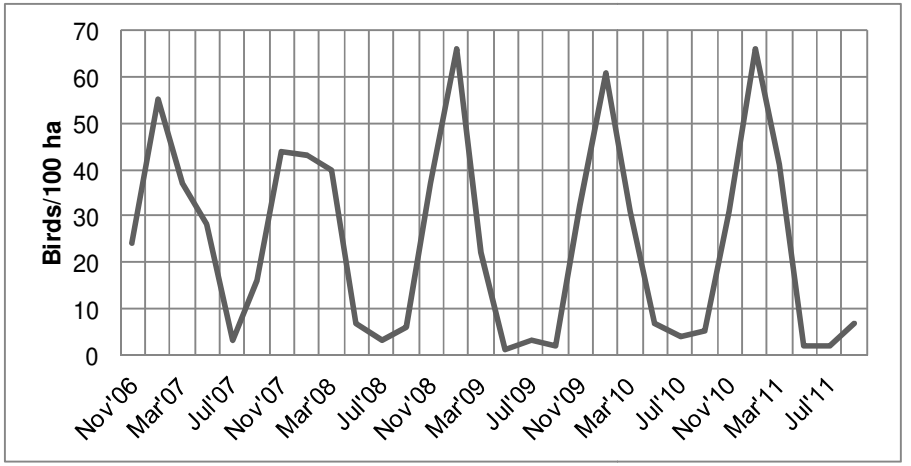

Figure 25a – Southern Red Bishop, observed densities 2006-2011

The brightly coloured breeding plumage of the males, as well as nest-building activity, make the birds very conspicuous during summer. By contrast, in winter they are difficult to detect in their drab non-breeding plumage, and this partly accounts for the sharp drop in observed densities (Figure 25b). In addition, dispersal beyond the study area into neighbouring undeveloped areas during winter was observed. No long-range seasonal movements are suspected.

Egg-laying in the region has been reported mainly from November to February (Hockey et al. 2005).

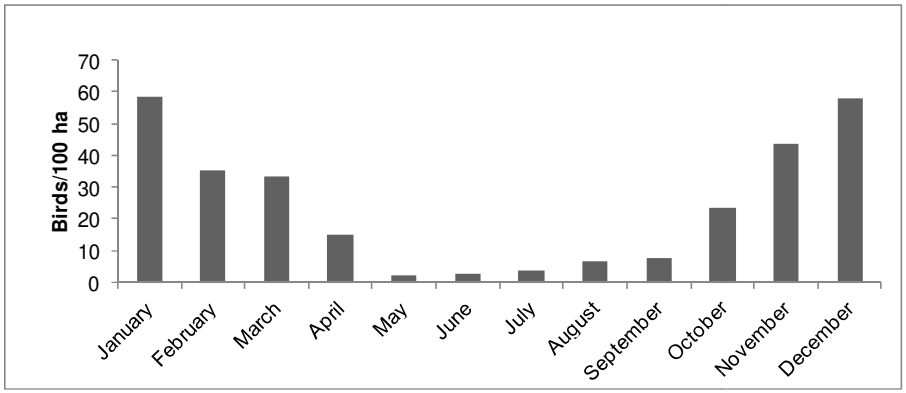

Figure 25b – Southern Red Bishop, seasonality

Little Swift *Apus affinis*

Little Swifts nest on tall buildings in the vicinity, mostly outside of the study area. Because of the abundance of suitable nest sites, they are more numerous now than they would have been before urbanisation. In the absence of buildings, they nest on cliffs and rock overhangs.

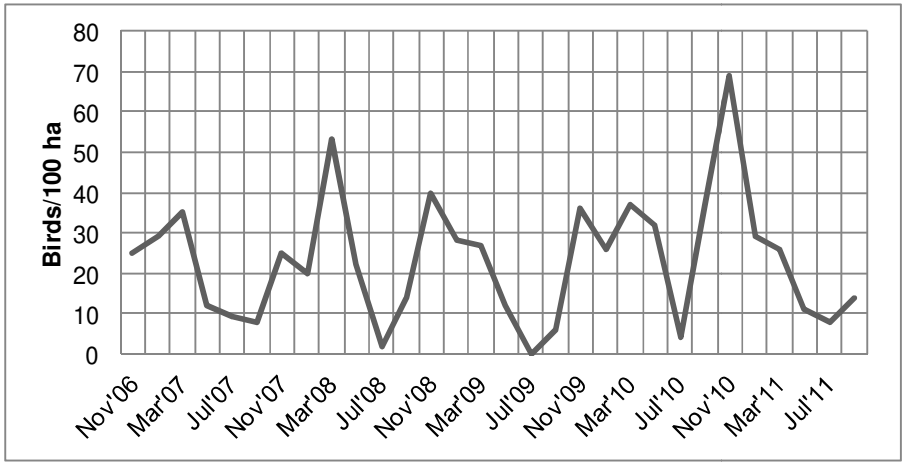

Figure 26a – Little Swift, observed densities 2006-2011

Although few birds are seen in winter, at least some are present throughout the year (Figure 26b). The nests are used for roosting outside of the breeding season. If the nest sites are kept under observation in mid-winter, the birds can be observed entering the nests around dusk each day. They are seldom seen during the rest of the day, presumably because they forage at higher altitudes in winter, and are out of sight of human observers most of the time.

Greater numbers were seen in the summer of 2010/2011 than in the other years (Figure 26a).

Egg-laying in South Africa has been reported mainly from September to December (Hockey et al. 2005).

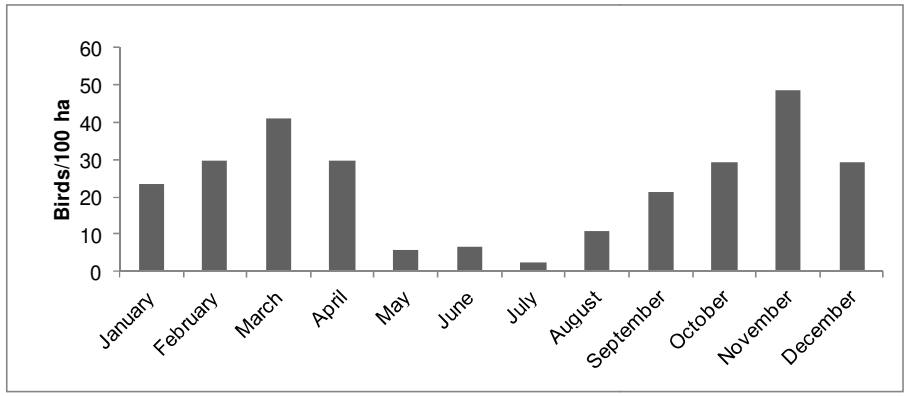

Figure 26b – Little Swift, seasonality

European Bee-eater *Merops apiaster*

A migrant which breeds in the Palearctic region and spends the northern winter (our summer) in southern Africa.

Greater numbers were seen in the summer of 2008/2009 than in other years (Figure 27a). They were usually seen in small groups (two to ten) and sometimes appeared to gather in a single flock (up to 80 birds) which circled noisily over Groenkloof in the late afternoon, before settling to roost in tall alien trees on the ridge of Klapperkop Hill.

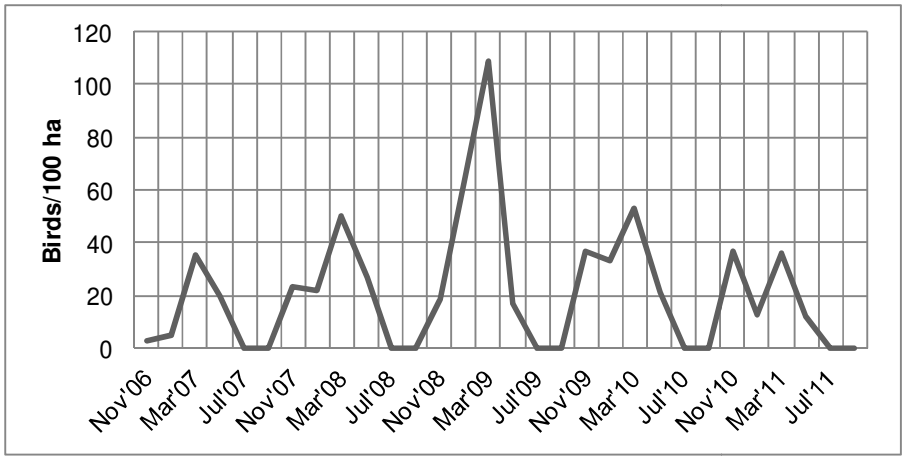

Figure 27a – European Bee-eater, observed densities 2006-2011

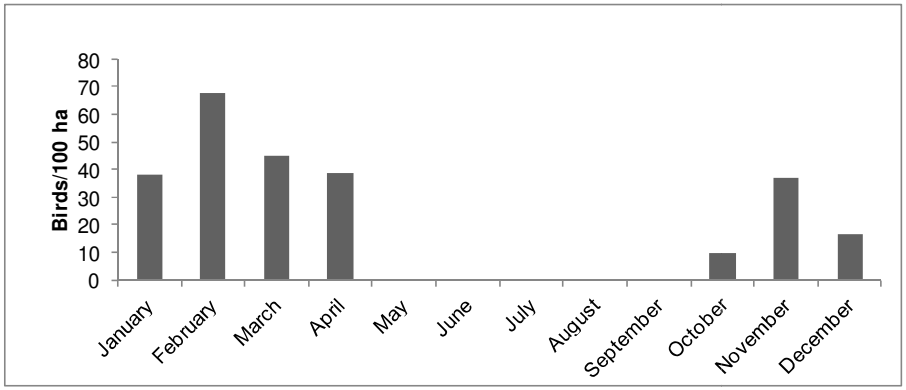

Figure 27b – European Bee-eater, seasonality

The birds arrive gradually from 2 October and leave abruptly in April (latest 17 April) (Figure 27b).

Streaky-headed Seedeater *Crithagra gularis*

The observed densities have increased gradually over the study period (Figure 28a).

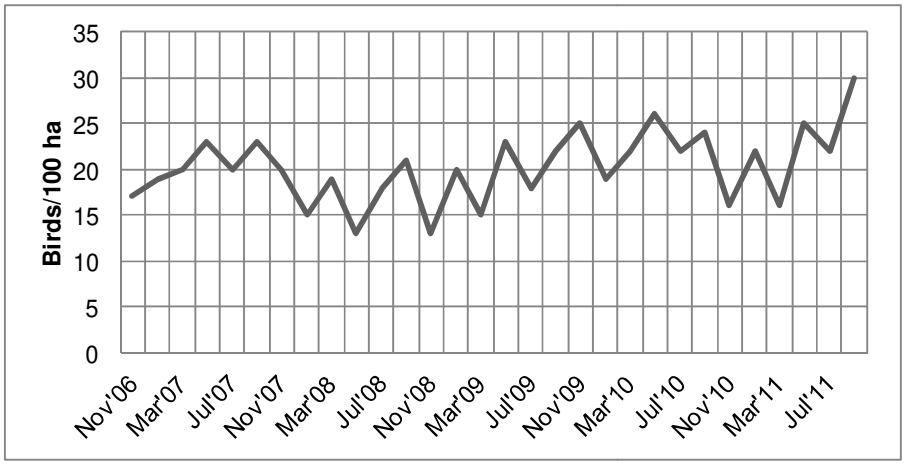

Figure 28a – Streaky-headed Seedeater, observed densities 2006-2011

The species appears to be sedentary, with no apparent seasonal pattern to the fluctuations in observed densities (Figure 28b). Within the suburban environment, the species appears to feed mostly from trees and shrubs rather than on grass seeds, and unlike for the Yellow-fronted and Black-throated Canaries, there is no evidence for movements between the suburb and surrounding natural grasslands.

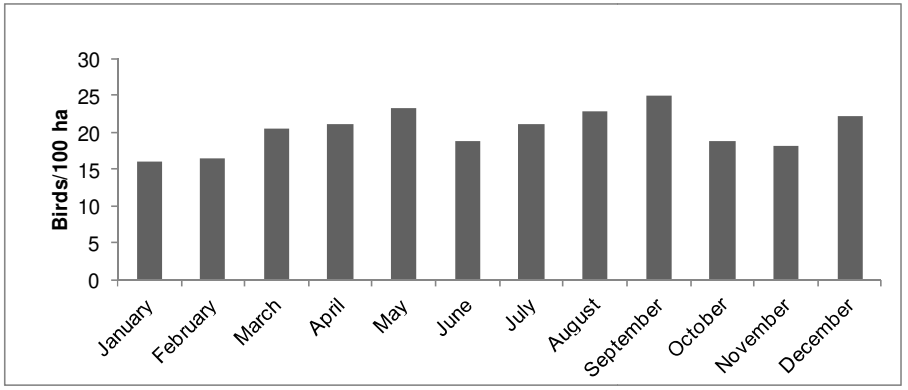

Figure 28b – Streaky-headed Seedeater, seasonality

Egg-laying in this region has been reported mainly from October to January (Hockey et al. 2005).

House Sparrow *Passer domesticus*
The species was introduced to South Africa from Europe and Asia and has been resident in Pretoria since the 1950s (Hockey et al. 2005). The population in Groenkloof appeared to be stable during the study period (Figure 29a). It is thought to have declined in parts of Pretoria (F Peacock pers. comm.).

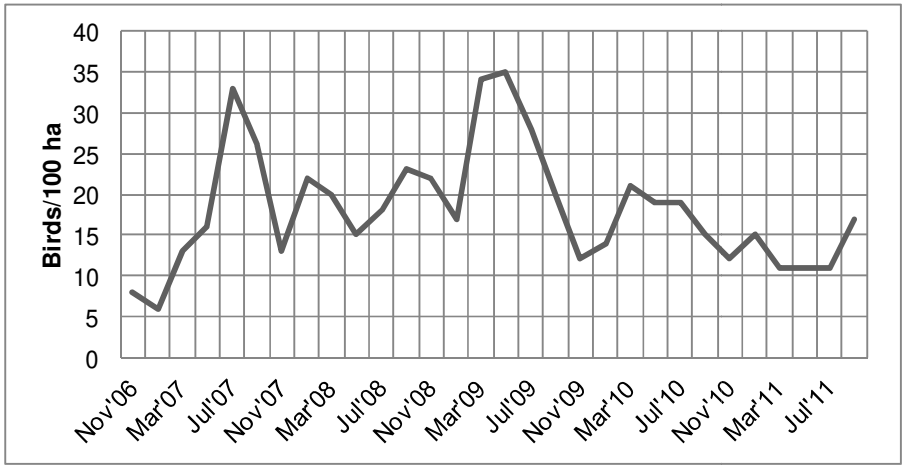

Figure 29a – House Sparrow, observed densities 2006-2011

The birds were seen mostly in the commercial parts of Groenkloof and only rarely in residential gardens and parks. Nests are mostly in cavities on buildings, but also inside the hollow horizontal beams on electricity supply pylons. These sites are also used by Southern Grey-headed Sparrows, but they are sufficiently numerous to suppose that there is no competition for them.

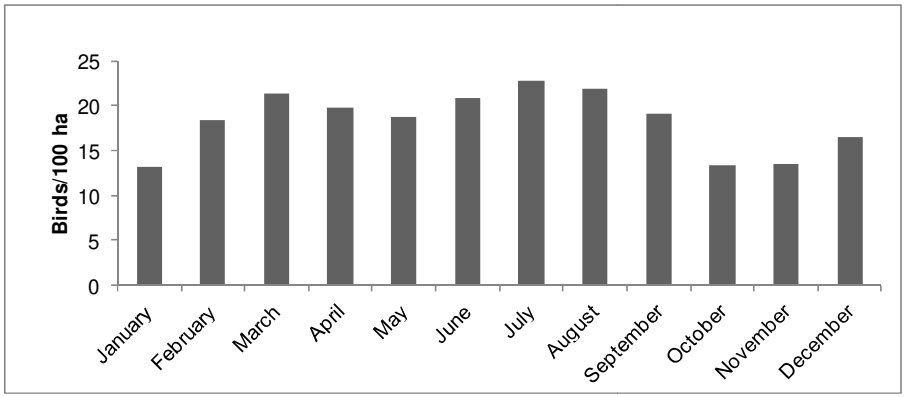

Figure 29b – House Sparrow, seasonality

Because the species is restricted to the vicinity of human habitation in South Africa, it is unlikely to undertake seasonal movements. However, the winter peak in observed densities suggests concentration at reliable food sources in winter and some dispersal in summer (Figure 29b). A different trend is evident in bird atlas data on a regional scale, with lowest reporting rates in March-April (Harrison et al. 1997). The difference suggests that the trend seen here reflects a local phenomenon. Communal roosting at regular sites (in small trees) was observed in winter.

Egg-laying occurs throughout the year, but mostly from September to December (Hockey et al. 2005).

Amethyst Sunbird *Chalcomitra amethystina*
The seasonal movements of the Amethyst Sunbird in South Africa are poorly known. This study shows that it is predominantly a non-breeding visitor to Groenkloof (Figure 30a; Parker 2011).

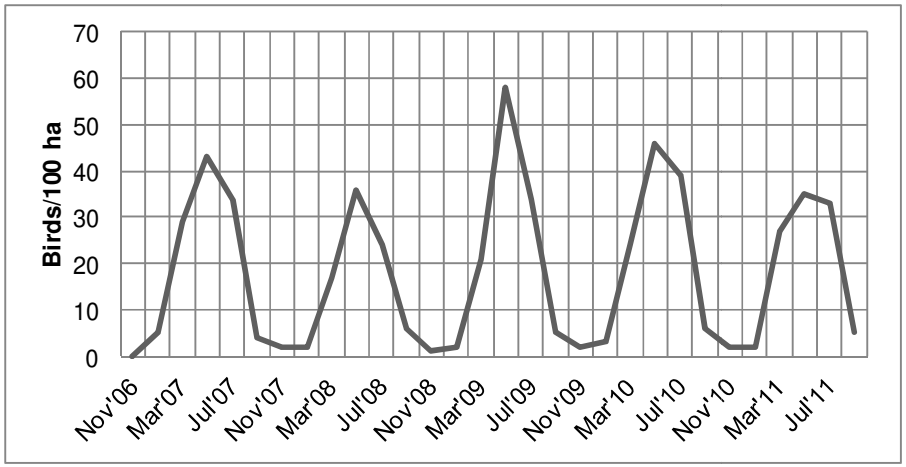

Figure 30a – Amethyst Sunbird, observed densities 2006-2011

A few birds are present throughout the year, but the majority arrive in February and March and depart before the end of July (Figure 30b). The observed densities show that this pattern is consistent from year to year. The breeding season in South Africa is mainly from October to February (Hockey et al. 2005). No breeding attempts were observed in Groenkloof or surroundings.

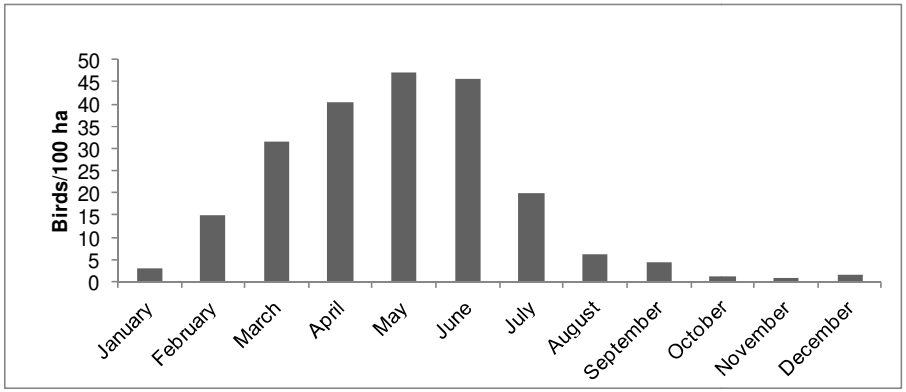

Figure 30b – Amethyst Sunbird, seasonality

Observations in the undeveloped areas around Groenkloof (Groenkloof Nature Reserve, Klapperkop Hill and the grounds of the Voortrekker Monument) showed the same pattern of seasonality. This rules out the possibility that the birds visiting the suburban habitat come from the surrounding undeveloped areas. The breeding grounds of the birds which visit Groenkloof are unknown, but may be to the west in North West Province (AJ Tree pers. comm.).

Greater Striped Swallow *Hirundo cucullata*

A summer migrant which breeds here and winters in central Africa. It overlaps in Groenkloof with the similar Lesser Striped Swallow. The Greater Striped Swallow is more common as a breeding species at higher altitudes to the south, while the Lesser Striped favours lower altitudes to the north and east. Fewer birds were observed in the summer of 2010/11 than in the previous years (Figure 31a).

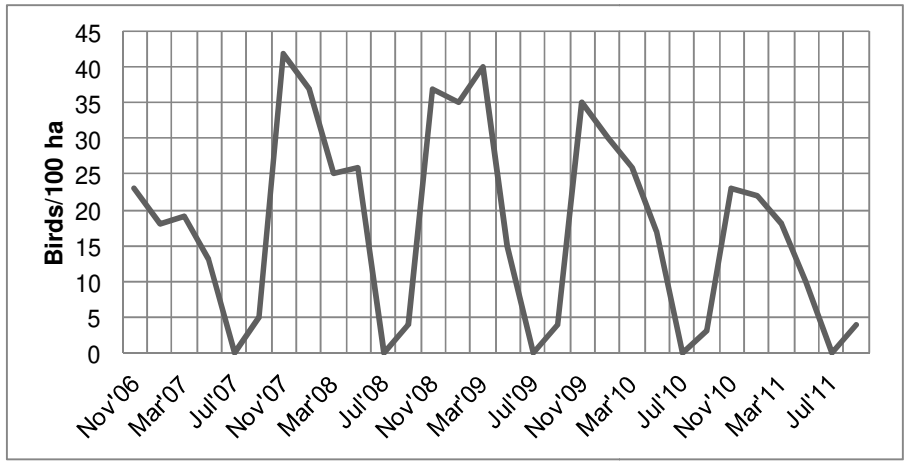

Figure 31a – Greater Striped Swallow, observed densities 2006-2011

They are continuously present and breed in Groenkloof from mid-September to April (Figure 31b). Birds seen in August (from 1 August) and May (till 21 May) may be in passage.

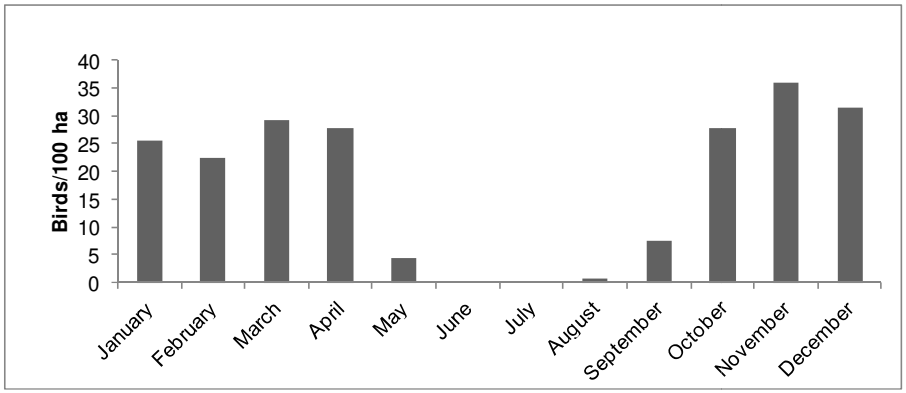

Figure 31b – Greater Striped Swallow, seasonality

African Olive-Pigeon *Columbia arquatrix*

The African Olive-Pigeon in Gauteng used to be confined to secluded wooded gullies. Around the turn of the millennium, it started infiltrating the greener suburbs of Johannesburg and Pretoria. By the beginning of the study period, it was established in Pretoria and possibly still increasing. There was a marked increase in the numbers seen in Groenkloof from 2006 to 2007 (Figure 32a). It is reported to have been resident and increasing in the suburb of Centurion (to the south of Groenkloof) since 2004 (E Marais pers. comm.).

There appears to be an influx into Groenkloof in the summer months (October to January), possibly co-inciding with the fruiting of various indigenous and alien trees (Figure 32b). However, the birds are most conspicuous after heavy rain showers, when they perch in the open on overhead cables in order to dry out, and this partly accounts for the peaks in observed densities. At these times, up to 30 birds can be seen within a single residential block. Bird atlas data on a regional scale do not show much seasonal variation in reporting rates (Harrison et al. 1997).

Breeding may occur at any time of year (Hockey et al. 2005).

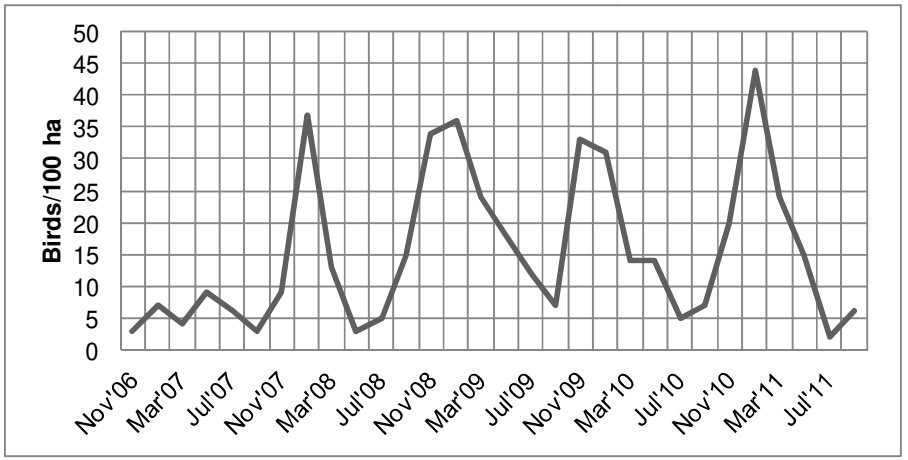

Figure 32a – African Olive-Pigeon, observed densities 2006-2011

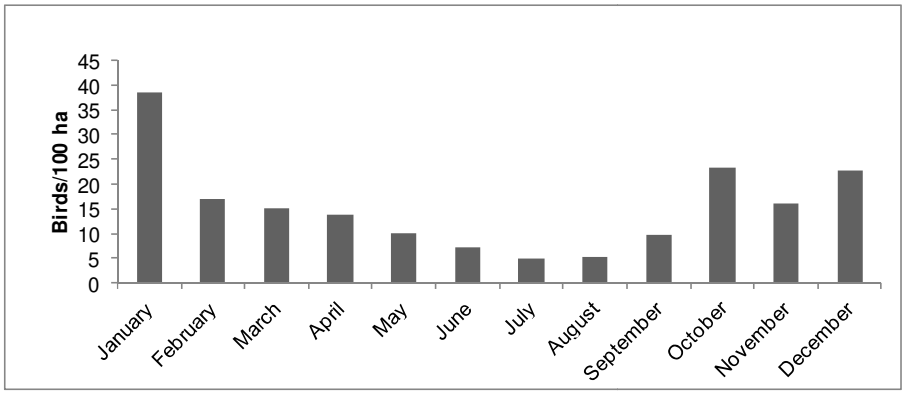

Figure 32b – African Olive-Pigeon, seasonality

Helmeted Guineafowl *Numida meleagris*

A flock of Helmeted Guineafowl is resident at the Austin Roberts Bird Sanctuary (Figure 33a). There they are able to feed on grain which is put out primarily for captive cranes and waterfowl. They occasionally venture outside of the bird sanctuary and are sometimes present in the grounds of the Harlequins Club and Pretoria Rugby Club. There may be some interchange with a separate population which resides in the natural grassland and bush of Klapperkop Hill, which borders

the study area. Partial albinism (with some individuals displaying varying amounts of white coloration) tends to occur among flocks which are isolated within an urban area, and among captive and semi-domesticated birds (pers. obs.), but was not observed here.

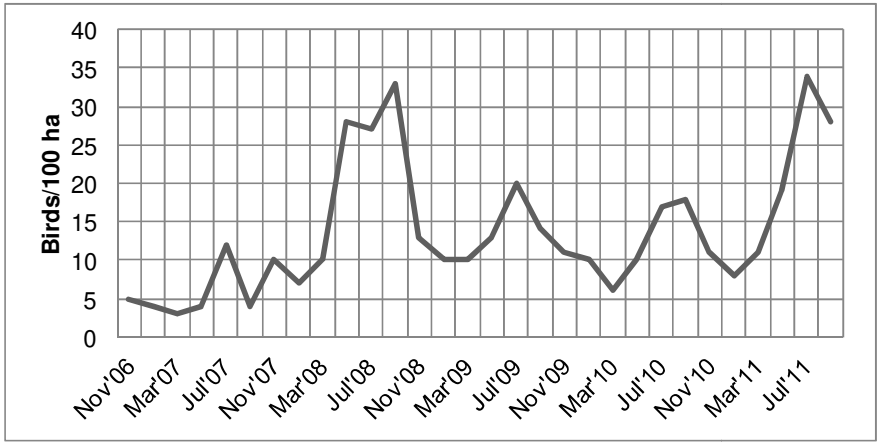

Figure 33a – Helmeted Guineafowl, observed densities 2006-2011

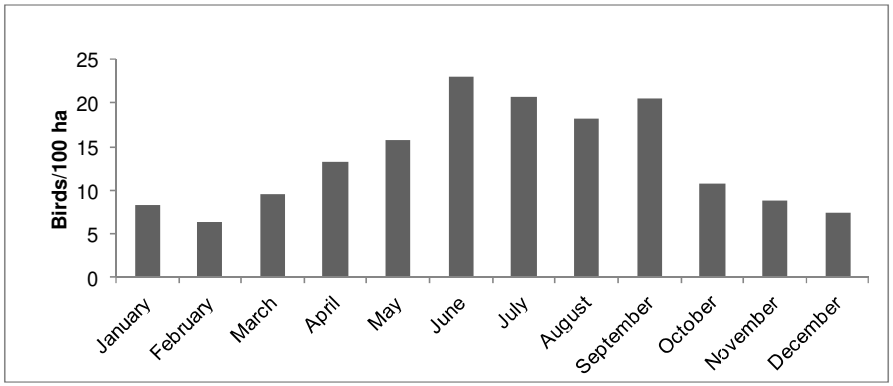

Figure 33b – Helmeted Guineafowl, seasonality

The observed numbers peak in winter (June to September), when the birds tend to congregate in a tight flock, which is augmented by recruitment of juveniles (Figure 33b). The birds become less conspicuous in summer, when they pair off to breed.

The flock size probably fluctuates around 30 birds.

Fiscal Flycatcher *Sigelus silens*

The pattern of observed densities is indicative of a population which is sedentary and stable (despite a noticeable decline in March 2007) (Figure 34a). It is most common in the northern, more elevated part of Groenkloof, adjoining the undeveloped land of Klapperkop Hill, and is hardly ever seen south of George Storrar Drive. They are known to congregate in some areas (Hockey et al. 2005), but they are not gregarious here at all, and no more than two birds were seen together except when a pair was accompanied by one or two young.

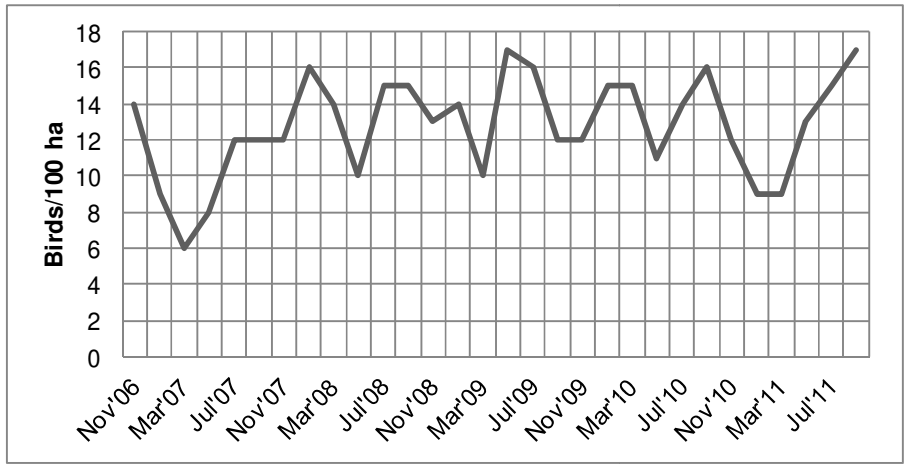

Figure 34a – Fiscal Flycatcher, observed densities 2006-2011

The species is endemic to South Africa and a migrant in parts of its range (Hockey et al. 2005), There is no evidence of seasonal movements here (Figure 34b), but it is reported to be a winter visitor in the south-east of Pretoria (F Peacock pers. comm.) and in the rural areas north of Pretoria (E Marais pers. comm.).

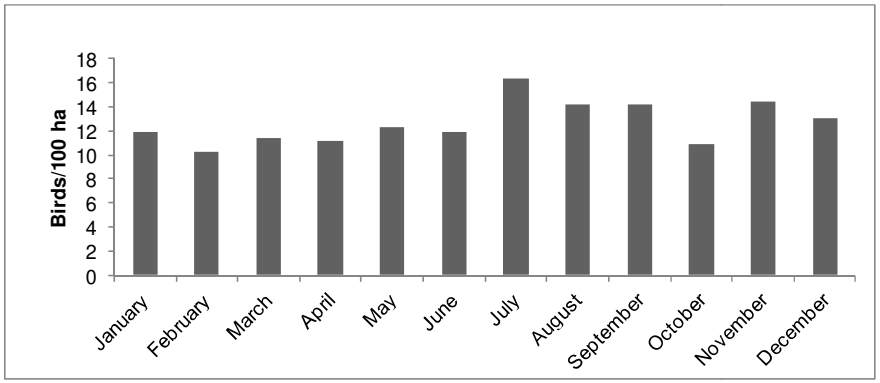

Figure 34b – Fiscal Flycatcher, seasonality

Breeding in South Africa has been recorded throughout the year, but mostly from October to December (Hockey et al. 2005).

Southern Boubou *Laniarius ferrugineus*

A skulking species which is detected by its vocalisations more often than by sight. Nevertheless, its observed densities were greater than those of the visually conspicuous Common Fiscal. There were significant dips in observed densities in February to April of 2007, 2008 and 2010, but not in 2009 and 2011 (Figure 35a).

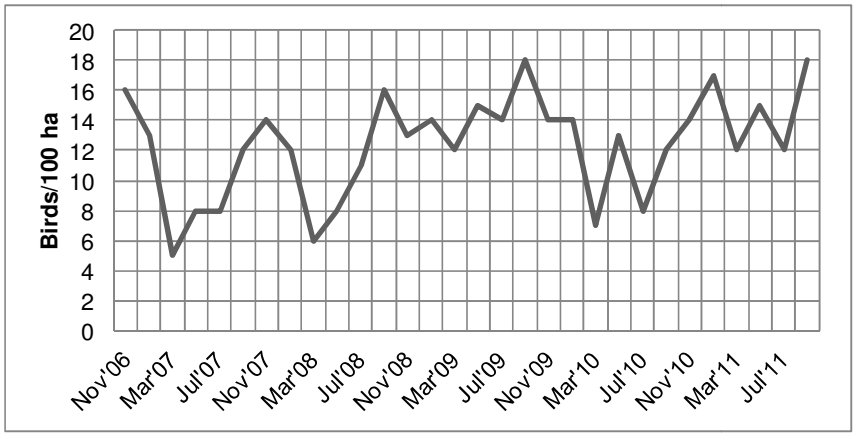

Figure 35a – Southern Boubou, observed densities 2006-2011

There is relatively little seasonal variation in observed densities, showing that the species is probably sedentary and also that it remains highly vocal throughout the year (Figure 35b).

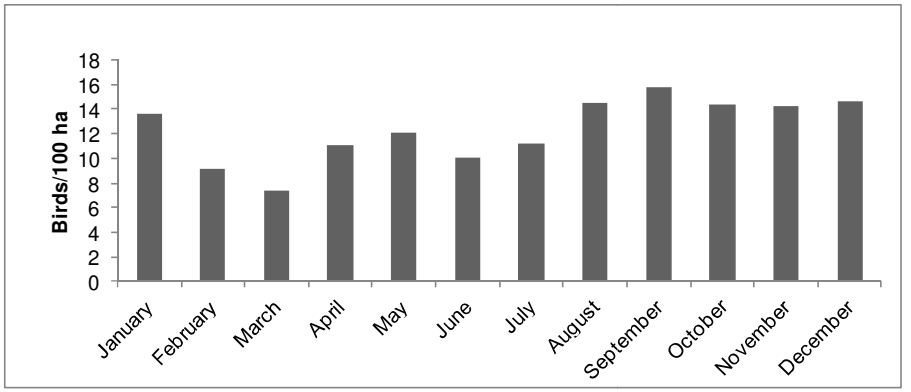

Figure 35b – Southern Boubou, seasonality

Egg-laying in this region has been reported from August to March and May (Hockey et al. 2005). This does not correlate well with the seasonality of observed densities, and some observation of breeding activity here is needed.

Village Weaver *Ploceus cucullatus*

A colony of Village Weavers has bred every year during the study period in reed-beds at the Austin Roberts Bird Sanctuary. It is on the edge of its range here, and is otherwise found in warmer regions to the north and east. Elsewhere in Gauteng, it has been known to breed only irregularly (F Peacock pers. comm.). The number of birds that breed may be largely affected by management of the reed-beds. The largest numbers were seen in 2006 (with more than 50 pairs breeding), followed by a sharp drop in 2007, a slight increase from 2008 to 2010 and a sharp increase in 2011 (Figure 36a).

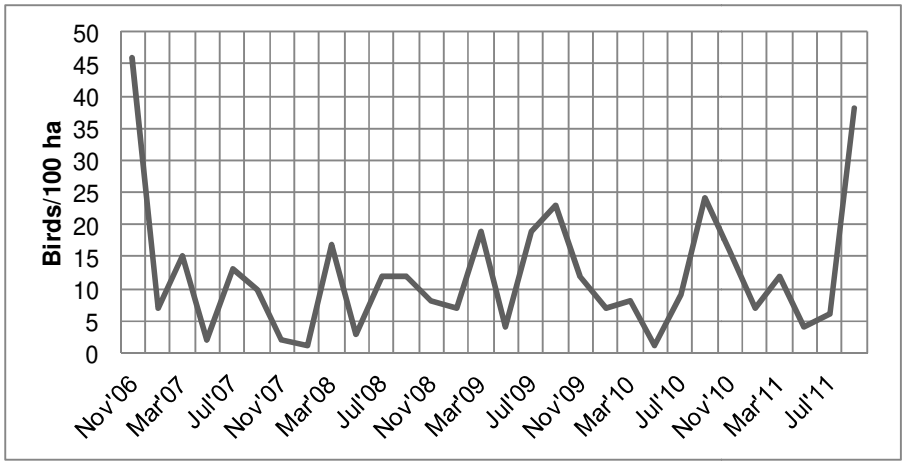

Figure 36a – Village Weaver, observed densities 2006-2011

When not breeding, they foraged throughout the study area and further afield. They are difficult to distinguish from the Southern Masked Weaver when in non-breeding plumage, and were therefore under-recorded. Observed densities were relatively high during January to March because some birds could still be found in the vicinity of the nests. Observed densities dropped when dispersal took place (April to June) (Figure 36b).

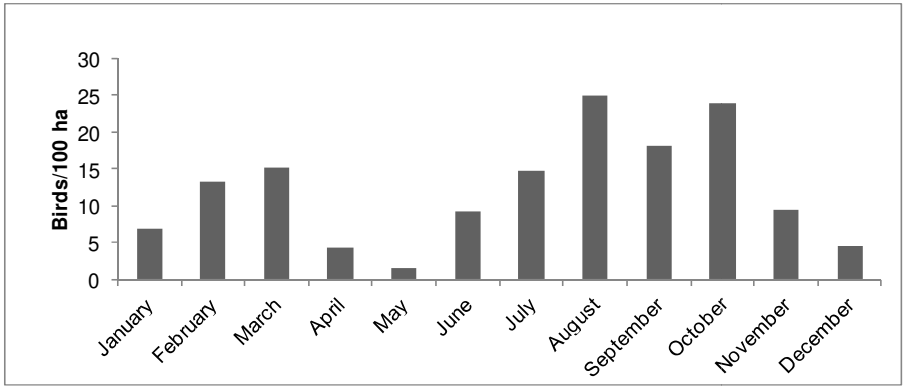

Figure 36b – Village Weaver, seasonality

Nest-building activity, as well as the bright breeding plumage of the males, made the birds especially conspicuous from July to October.

Crowned Lapwing *Vanellus coronatus*

Crowned Lapwings frequent parks, playing fields and other grassed open areas throughout the study area. They move in and out of the study area on a daily basis, in response to temporary disturbance at their favoured localities or foraging opportunities elsewhere.

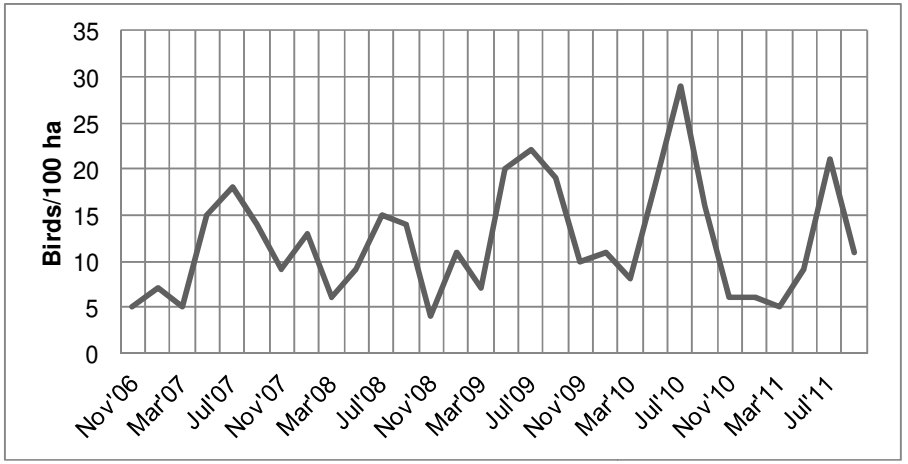

Figure 37a – Crowned Lapwing, observed densities 2006-2011

They favour areas with short grass cover. They will move into the neighbouring undeveloped lands after grass fires and will desert localities where the grass is becoming rank (Figure 37a).

Breeding may occur throughout the year, but mainly August to December (Hockey et al.). The winter peak in observed densities is influenced by the fact that the birds disperse when breeding and gather in small flocks (up to 11 birds) when not breeding (Figure 37b). A similar trend is evident in reporting rates on a regional scale in the bird atlas data for southern Africa (Harrison et al. 1997).

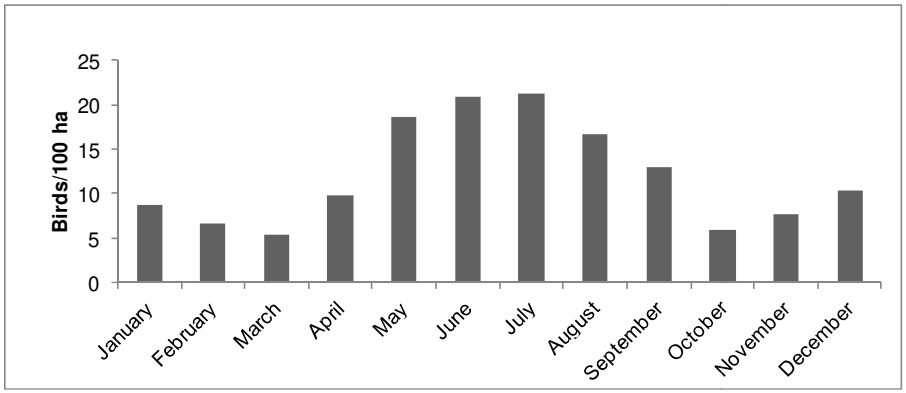

Figure 37b – Crowned Lapwing, seasonality

Cape Glossy Starling *Lamprotornis nitens*

A breeding resident, mostly seen in pairs, and no more than five were seen together at any time within the study area. However, congregations of 20 or more were sometimes seen in the neighbouring undeveloped land of Klapperkop Hill. Numbers reached a peak in the winter of 2009, and appear to have declined since then (Figure 38a).

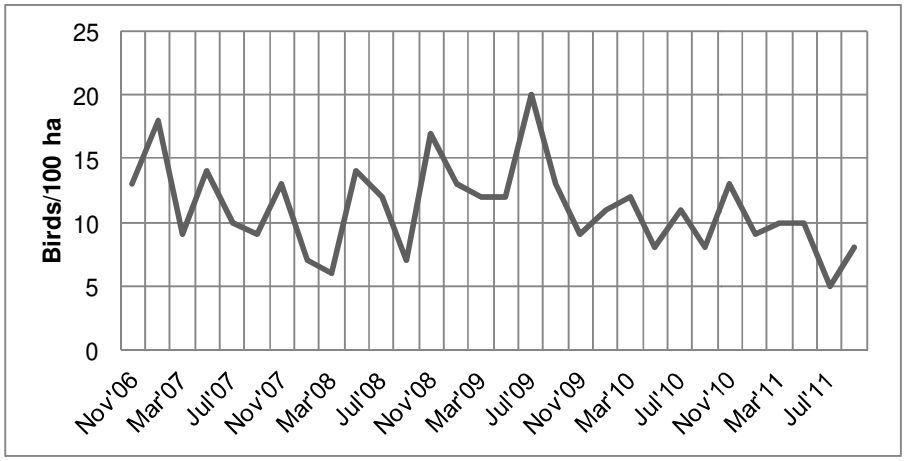

Figure 38a – Cape Glossy Starling, observed densities 2006-2011

Lack of a seasonal pattern to the observed densities indicates that the species is probably sedentary here (Figure 38b). However, short-term movements out of the study area into the neighbouring undeveloped areas were observed.

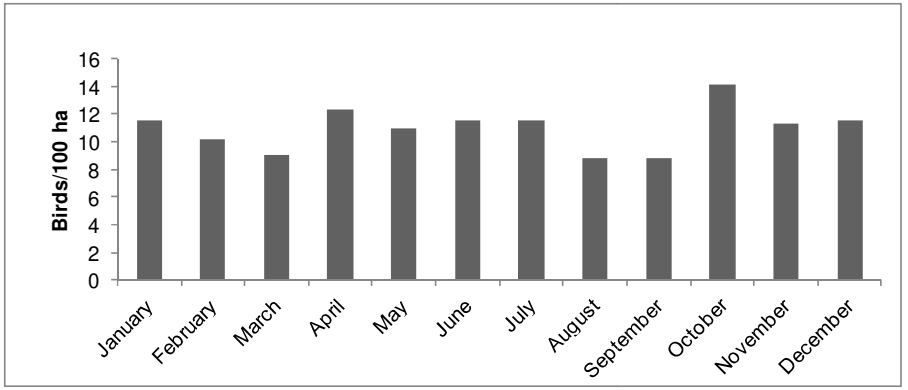

Figure 38b – Cape Glossy Starling, seasonality

Breeding occurs mostly from September to February (Hockey et al. 2005).

Red-winged Starling *Onychognathus morio*

Red-winged Starlings are resident but subject to movements in and out of the study area on a daily basis (Figure 39a). They nest on buildings and other man-made structures. Before urbanisation, they nested on cliffs and were probably less numerous here than they are now. The preferred nest and roosting sites appear to be the tall pylons which support overhead lights along the highway, which is located a short distance outside the study area. A few pairs nest on residential buildings within the study area.

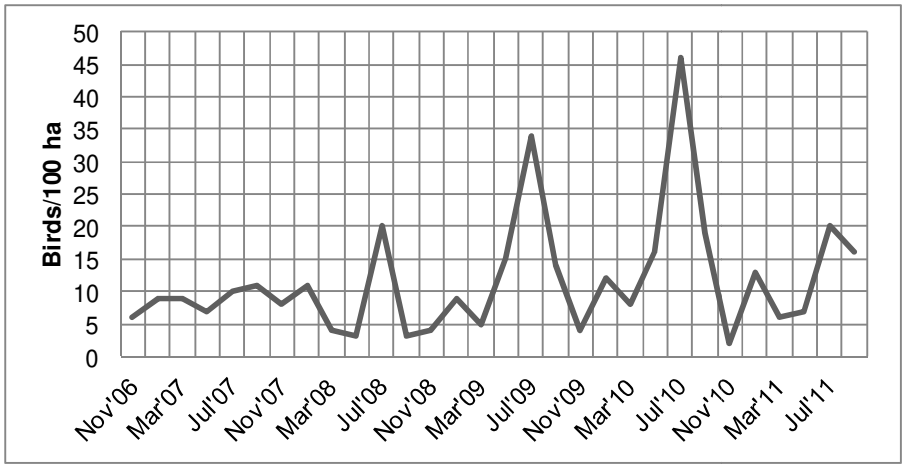

Figure 39a – Red-winged Starling, observed densities 2006-2011

Two factors influence the winter spikes in observed densities. Breeding mostly takes place at sites outside of the study area (as described above), so that fewer birds are present within the study area in the breeding season. When not breeding, the birds show a variable tendency to flock. During 2008, 2009 and 2010, flocks of 20 or more birds (maximum 24) were seen moving about the study area. During 2007 and 2011, the birds dispersed in smaller groups, and overall numbers were not necessarily reduced. It is possible that there are long distance seasonal movements, and these may be obscured by the daily and other short-term movements (Figure 39b). There is no apparent seasonal trend in bird atlas reporting rates on a regional scale (Harrison et al. 1997), confirming that the trend seen here is a local phenomenon.

Breeding occurs from September to March (Hockey et al. 2005).

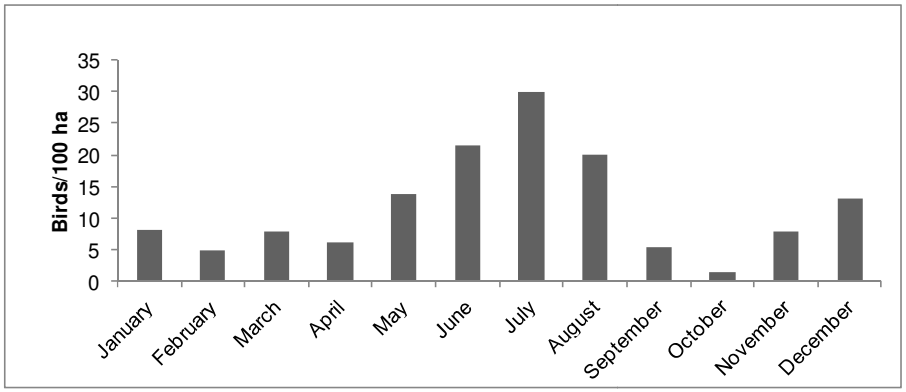

Figure 39b – Red-winged Starling, seasonality

African Hoopoe *Upupa africana*

Despite a high frequency and amplitude of short-term fluctuations in observed densities, there does not appear to be any long-term trend, nor any seasonal pattern to the fluctuations (Figure 40a).

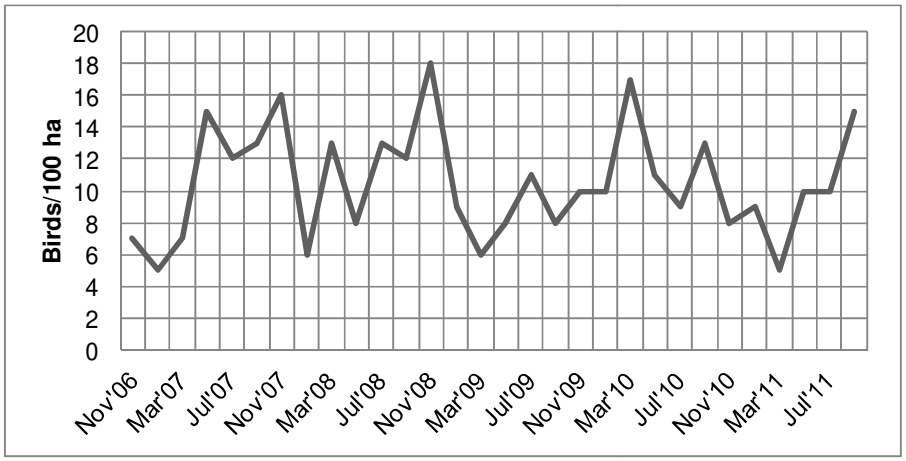

Figure 40a – African Hoopoe, observed densities 2006-2011

The species is a migrant in parts of its southern African range (Harrison et al. 1997), but there is no evidence of seasonal movements here. However, it is thought to be mainly a winter visitor

in the south-east of Pretoria (F Peacock pers. comm.). Because it is visually conspicuous at all times, it is unlikely that changes in conspicuous influence the fluctuations in observed densities. The overall impression is of a restless species which does not stay long in one location, but moves frequently over short distances (Figure 40b).

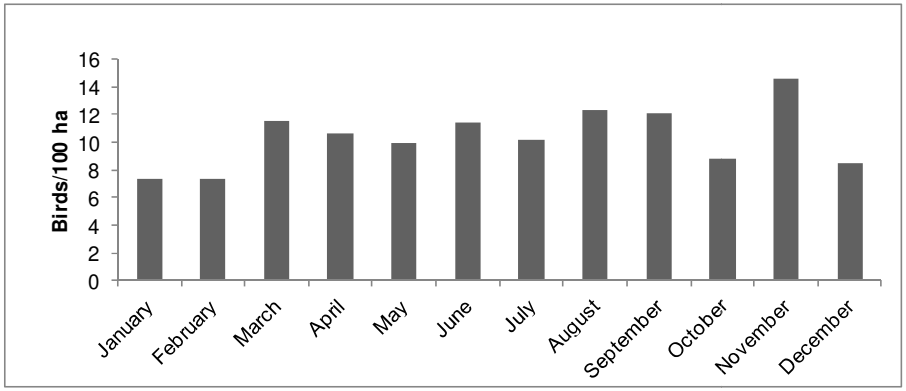

Figure 40b – African Hoopoe, seasonality

The reported egg-laying dates in southern Africa are from August to February with a peak from September to November (Hockey et al. 2005).

White-rumped Swift *Apus caffer*
A migrant which breeds here in the summer and spends the non-breeding season in central Africa. The numbers present at the peak of the breeding season appeared to be more or less constant from year to year (Figure 41a).

The birds were present between 11 September and 1 May each season (Figure 41b).

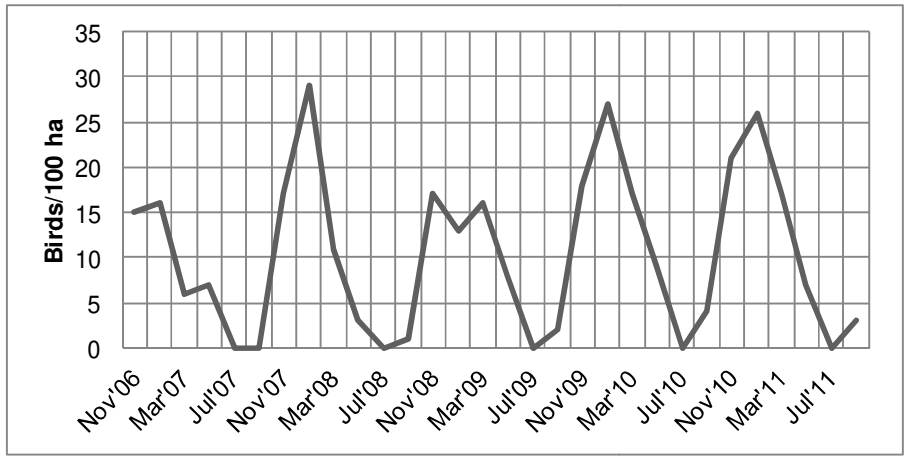

Figure 41a – White-rumped Swift, observed densities 2006-2011

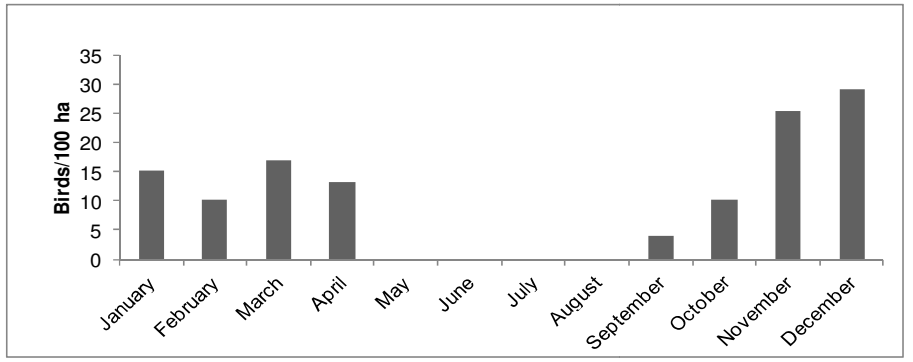

Figure 41b – White-rumped Swift, seasonality

Nests are placed on the larger residential buildings which are found at the southern end of the study area. Breeding occurs throughout the period of residence here.

Red-collared Widowbird *Euplectes ardens*
During the spring (August to October), flock after flock in quick succession (50 to hundred birds at a time) move through the suburb in the early morning to spend the day foraging in the natural grasslands beyond the built-up area, and return at dusk to roost in

the reed-beds at the Austin Roberts Bird Sanctuary. At this time, most of the males are in partial breeding plumage, making the flocks both unmistakeable and spectacular. The numbers involved easily exceed 1 000 birds. Breeding takes place in the natural grasslands and marshes outside the study area from November to March, and the birds are rarely seen within the suburb until the following spring.

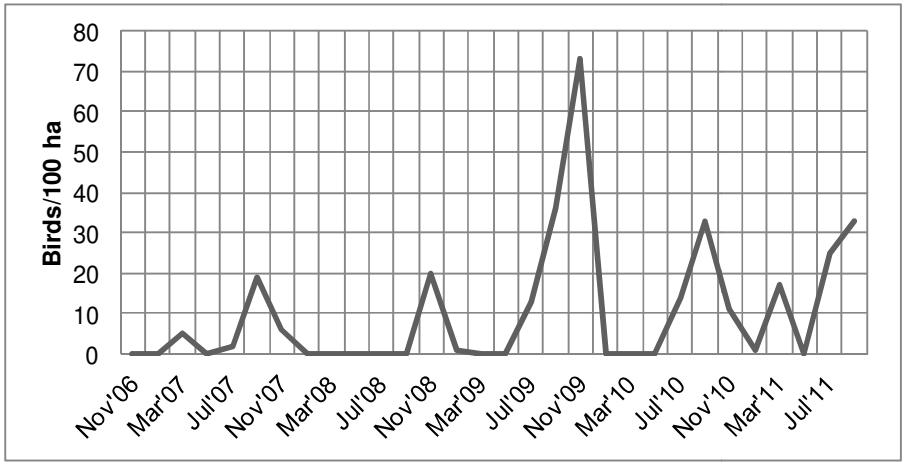

Figure 42a – Red-collared Widowbird, observed densities 2006-2011

The variation in observed densities are greatly influenced by whether the daily movements coincided with the time of transect counts, and no conclusions can be drawn about changes in the population size from year to year (Figure 42a,b).

Apart from daily commuting in and out of the study area, seasonal movements over longer distances are not suspected.

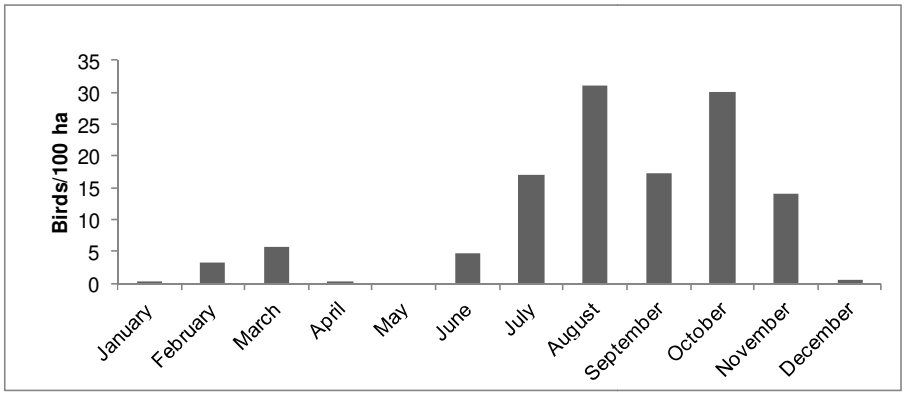

Figure 42b – Red-collared Widowbird, seasonality

Common Fiscal *Lanius collaris*

The observed densities indicate that the species may have declined slightly over the study period (Figure 43a).

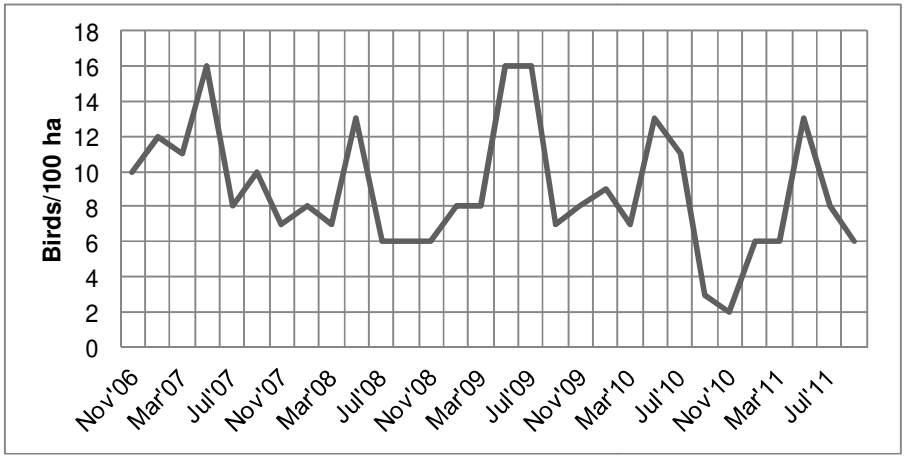

Figure 43a – Common Fiscal, observed densities 2006-2011

The seasonality of observed densities presents a pattern that one might expect from a sedentary, summer breeding species (Figure 43b). The autumn (April to May) peak may coincide with recruitment of young into the population, and a gradual decline through the

winter (June to September) with mortality and dispersal. The birds are highly conspicuous at all times of year. No seasonal movements are suspected. The bird atlas data on a regional scale do not show any seasonality in reporting rates (Harrison et al. 1997).

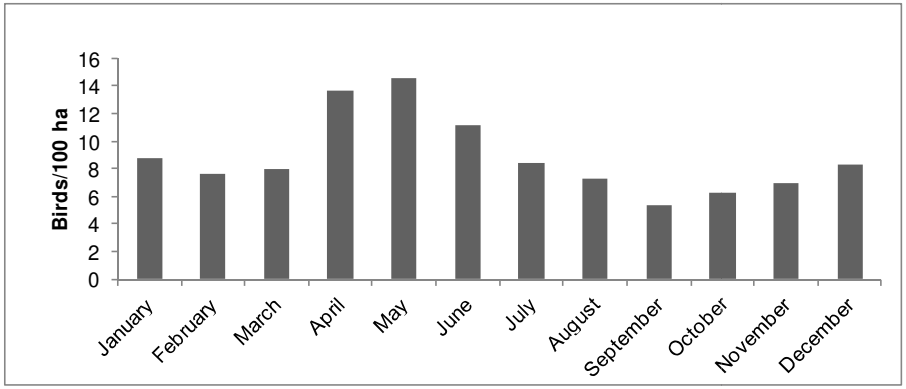

Figure 43b – Common Fiscal, seasonality

Egg-laying records from the region are mostly from August to December (Hockey et al. 2005).

Arrow-marked Babbler *Turdoides jardineii*
Peak densities were observed in the winter of 2008 and observed densities were lower but stable thereafter (Figure 44a). The birds were invariably seen in family groups of up to ten birds.

Relatively little seasonal variation in observed densities is consistent with a sedentary lifestyle. The higher densities in June, August and September may indicate a higher frequency of territorial displays (Figure 44b).

Breeding for the region has been reported mainly from September to April (Hockey et al. 2005).

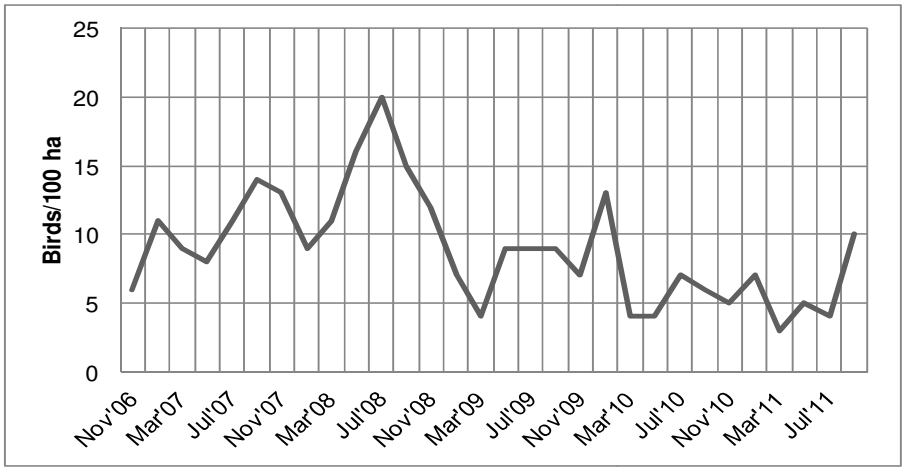

Figure 44a – Arrow-marked Babbler, observed densities 2006-2011

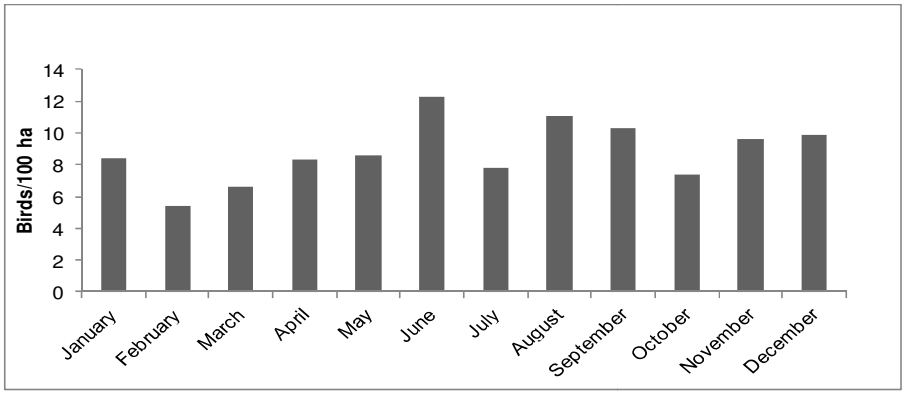

Figure 44b – Arrow-marked Babbler, seasonality

Green Wood-Hoopoe *Phoeniculus purpureus*
The observed densities suggest a population that was stable during the study period, despite sizeable fluctuations (Figure 45a). The birds were usually seen in family groups of up to 8 birds.

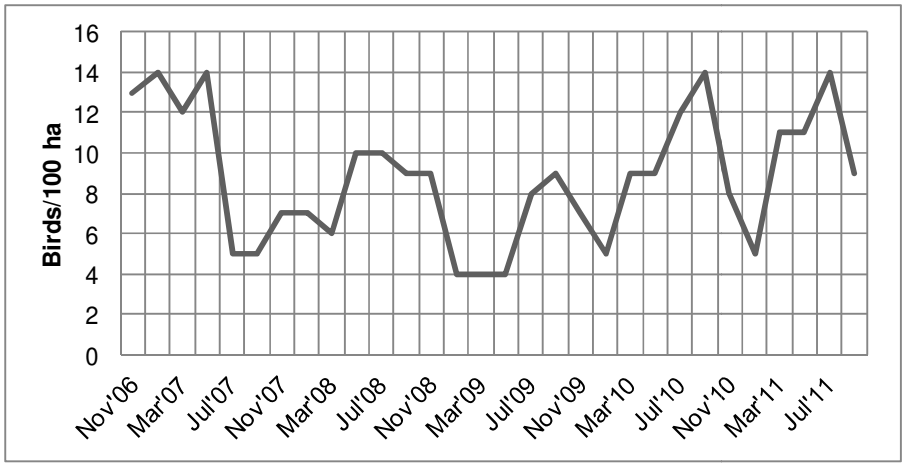

Figure 45a – Green Wood-Hoopoe, observed densities 2006-2011

Although the pattern of fluctuations for 2010 was repeated in 2011, the fluctuations generally did not conform to a seasonal pattern (Figure 45b). The species is believed to be mainly sedentary, with possible movements over short distances in and out of the study area. It is conspicuous at all times of year.

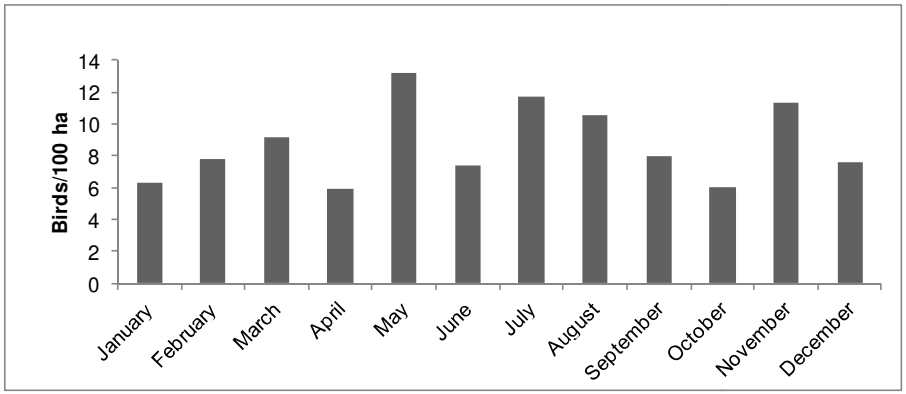

Figure 45b – Green Wood-Hoopoe, seasonality

Breeding is mainly from August to March (Hockey et al. 2005).

Yellow-fronted Canary *Crithagra mozambicus*

There was a marked increase in observed densities from mid-2010 to the end of the study period (Figure 46a).

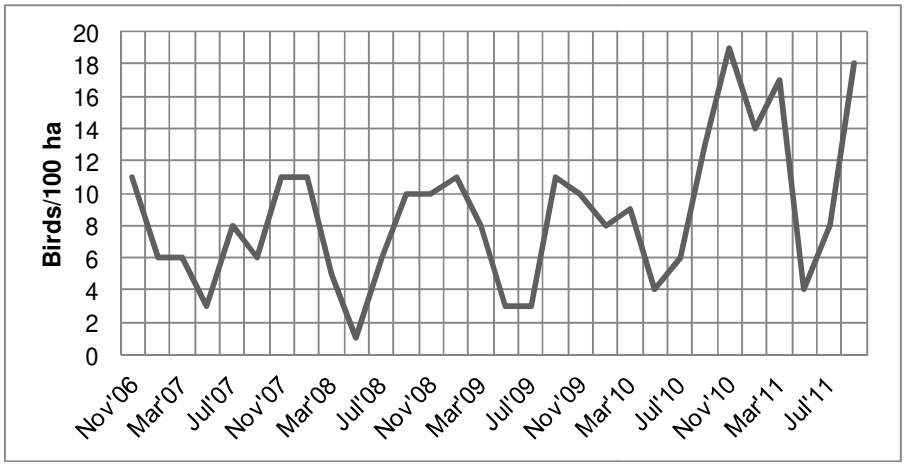

Figure 46a – Yellow-fronted Canary, observed densities 2006-2011

There appear to be seasonal movements on a local scale (Figure 46b). During autumn (April to June), when the birds are scarce in the study area, flocks can be found foraging among natural grasses and shrubs in the neighbouring undeveloped areas. There is little seasonality in reporting rates on a regional scale in the bird atlas data (Harrison et al. 1997), confirming that the trend seen here is a local phenomenon.

Breeding takes place mainly from October to April (Hockey et al. 2005). Breeding was not confirmed within the study area and possibly only takes place among natural vegetation in the neighbouring undeveloped areas.

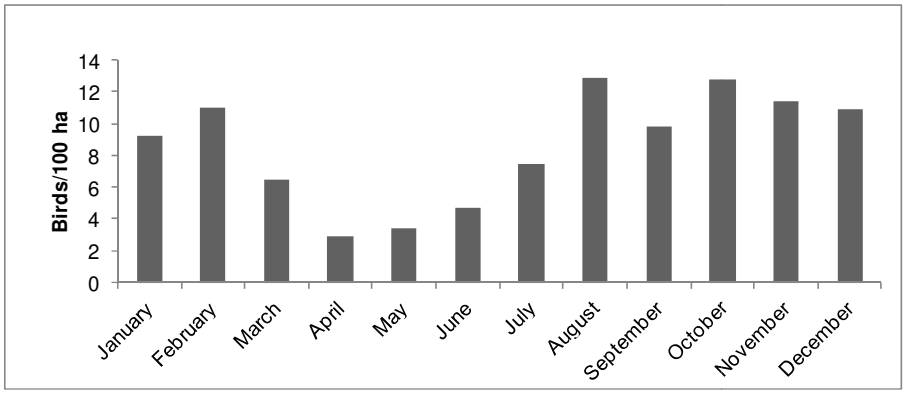

Figure 46b – Yellow-fronted Canary, seasonality

Cut-throat Finch *Amadina fasciata*

The Cut-throat Finch is not a typical garden bird, and perhaps the high numbers of 2006 to 2008 need more explanation than the low numbers of 2010 and 2011 (Figure 47a). In 2006 to 2007, the birds were seen in groups of six to twelve, and subsequently only in ones and twos. The nests are usually placed inside disused weaver nests (Hockey et al. 2005). The initial peak and subsequent decline in numbers coincided with the peak and decline in breeding by Village Weavers at the Austin Roberts Bird Sanctuary. Possibly the Cut-throat Finches bred opportunistically when there was an abundance of disused Village Weaver nests available.

The relative scarcity in winter may be due to movement into the natural grasslands neighbouring the study area, as for other seed-eaters including the Yellow-fronted Canary and Black-throated Canary (Figure 47b).

Breeding in South Africa has been reported from December to May (Hockey et al. 2005).

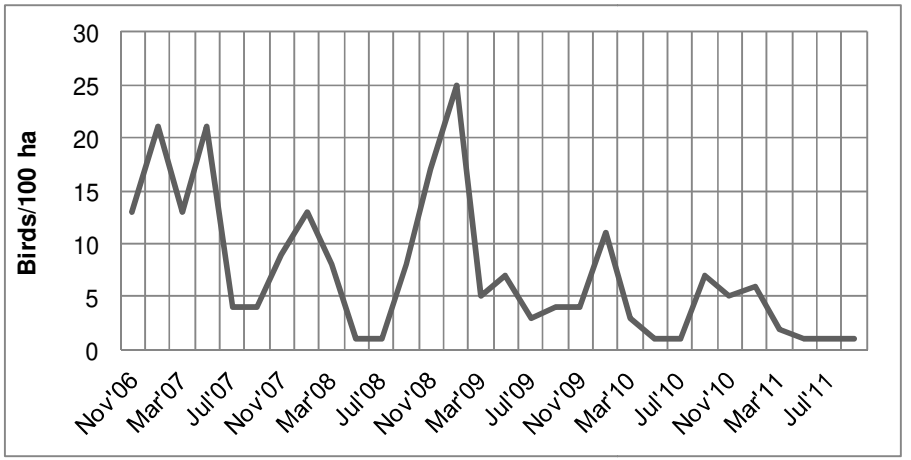

Figure 47a – Cut-throat Finch, observed densities 2006-2011

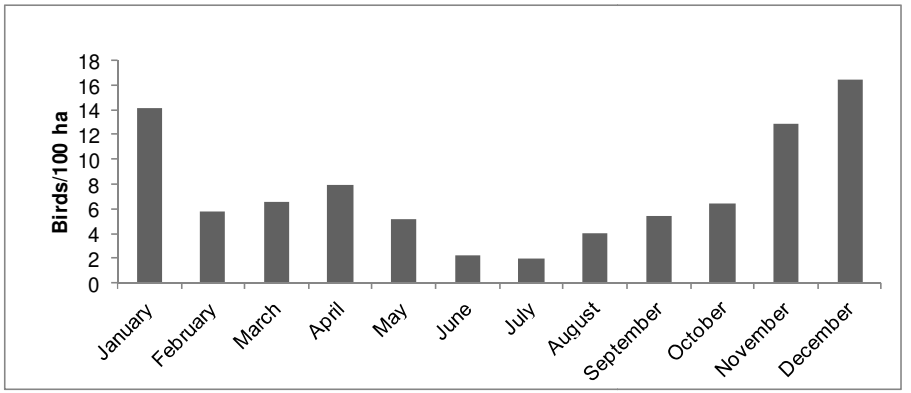

Figure 47b – Cut-throat Finch, seasonality

African Green-Pigeon *Treron calva*

There was no clear trend to the observed densities over the study period. Greater numbers were observed in 2008 to 2010 than in 2007 and 2011 (Figure 48a).

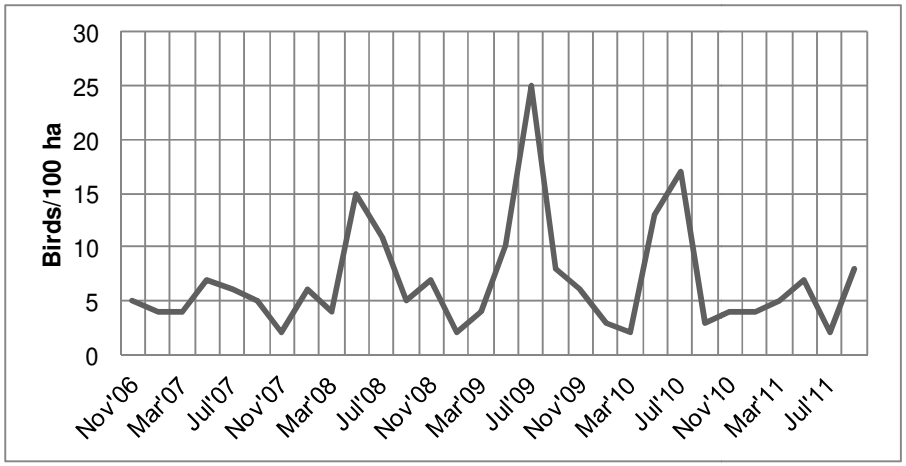

Figure 48a – African Green-Pigeon, observed densities 2006-2011

There is an annual winter influx into the study area, possibly from the nearby undeveloped areas (Figure 48b). During this time concentrations (up to 26 birds) are seen at various indigenous and alien fruiting trees. Lack of a seasonal trend in the bird atlas data on a regional scale (Harrison et al. 1997) confirms that the trend seen here is a local phenomenon.

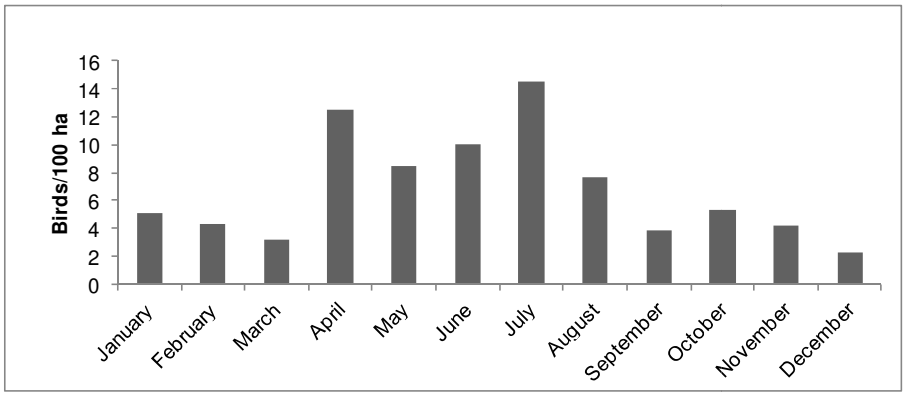

Figure 48b – African Green-Pigeon, seasonality

Breeding takes place mainly from August to January (Hockey et al. 2005).

Cape Weaver *Ploceus capensis*

The Cape Weaver is a breeding summer visitor to the study area. The observed densities showed an increase in the final year of the study period over the previous years (Figure 49b). It is near the edge of its range here, and is more common in the cooler regions to the south. It is endemic to South Africa and Swaziland.

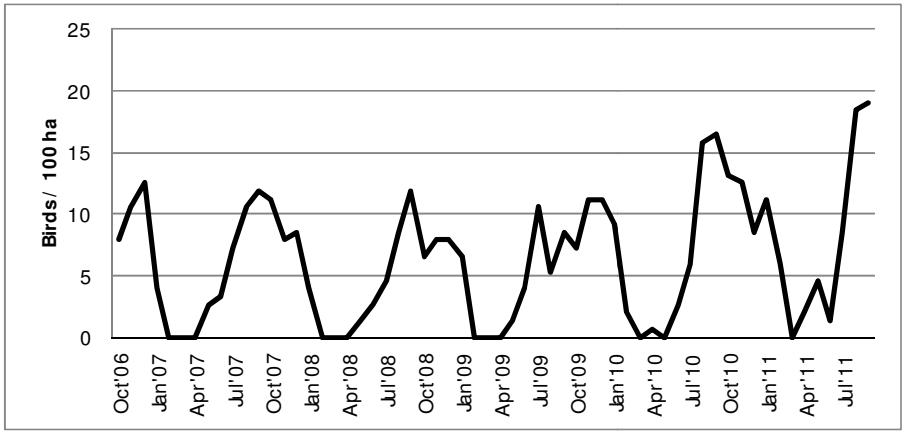

Figure 49a – Cape Weaver, observed densities 2006-2011

Over most of its range it does not appear to be migratory, but it is a winter visitor to parts of the south coast (Harrison et al. 1997). The annual exodus from the study area in February to June may be southwards to the Witwatersrand (Figure 49b). Breeding was seen only at the Jan Cilliers Park. Nests were placed in trees that overhang ornamental ponds. There were no more than five nests active at any time. Single birds were occasionally seen foraging at other sites within the study area.

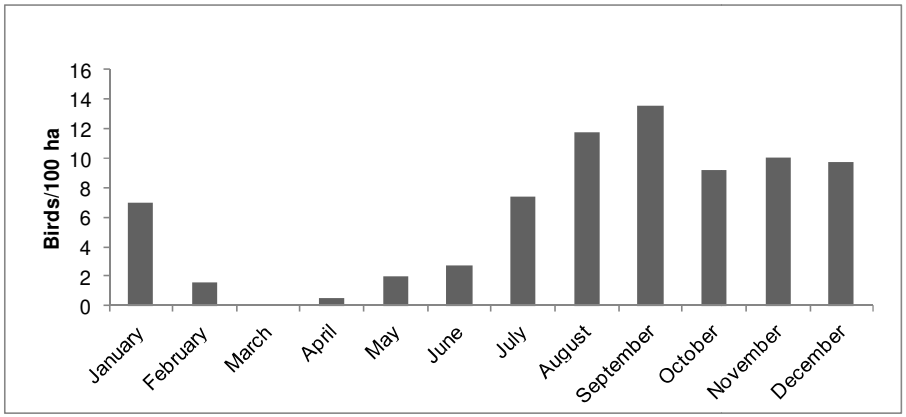

Figure 49b – Cape Weaver, seasonality

Breeding activity was observed from July to January.

Black-backed Puffback *Dryoscopus cubla*
The observed densities increased steadily during the study period, suggesting that the species is still in the process of adapting to the suburban habitat (Figure 50a).

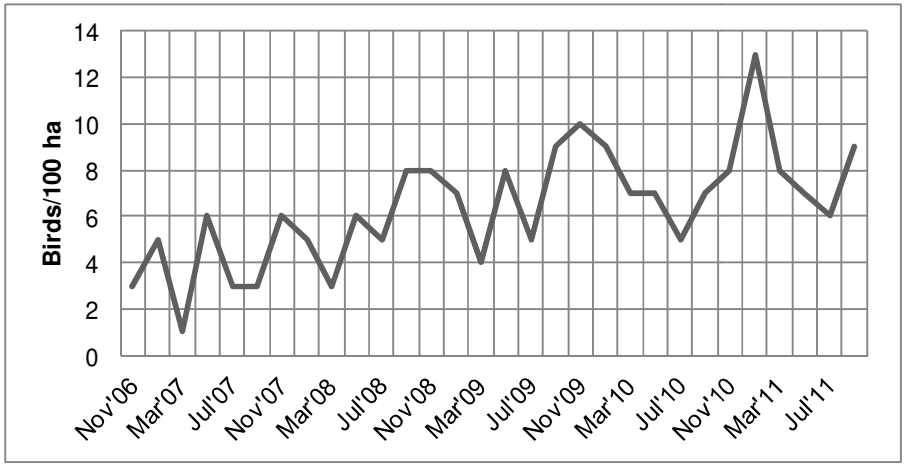

Figure 50a – Black-backed Puffback, observed densities 2006-2011

Apart from a summer peak in observed densities, there was no clear pattern to the seasonal variations, suggesting that it is resident (Figure 50b).

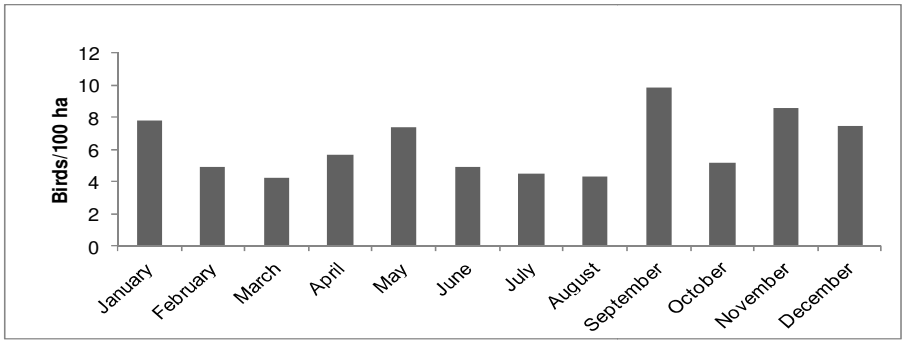

Figure 50b – Black-backed Puffback, seasonality

Breeding in this region occurs mainly from October to January (Hockey et al. 2005).

Black-headed Oriole *Oriolus larvatus*
Observed densities tended to increase from 2007 to 2009, and then declined to previous levels (Figure 51a).

The mid-winter peak may be due to birds from the undeveloped areas outside the suburb seeking refuge here, where food and water remain plentiful (Figure 51b). It is not likely that increased visibility due to reduced foliage in winter greatly influences the observed densities, because the bird was most often detected by its calls before it was seen, even in winter. Bird atlas data on a regional scale showed a peak in reporting rates in August – September (Harrison et al. 1997).

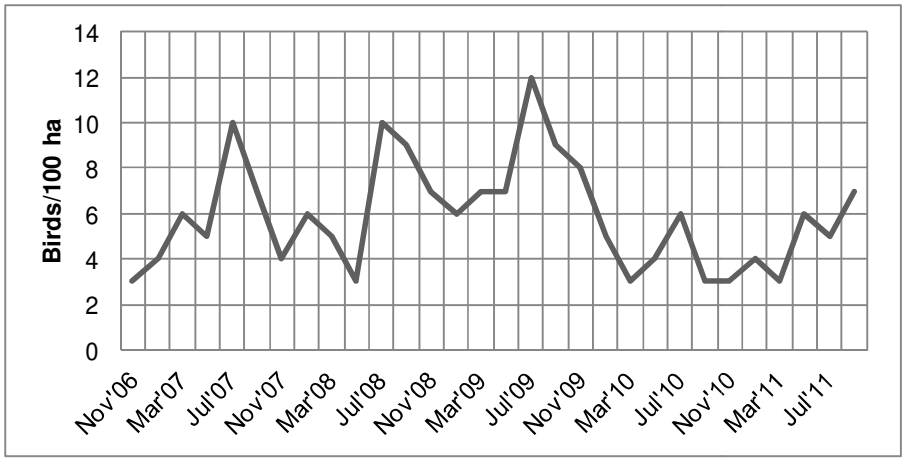

Figure 51a – Black-headed Oriole, observed densities 2006-2011

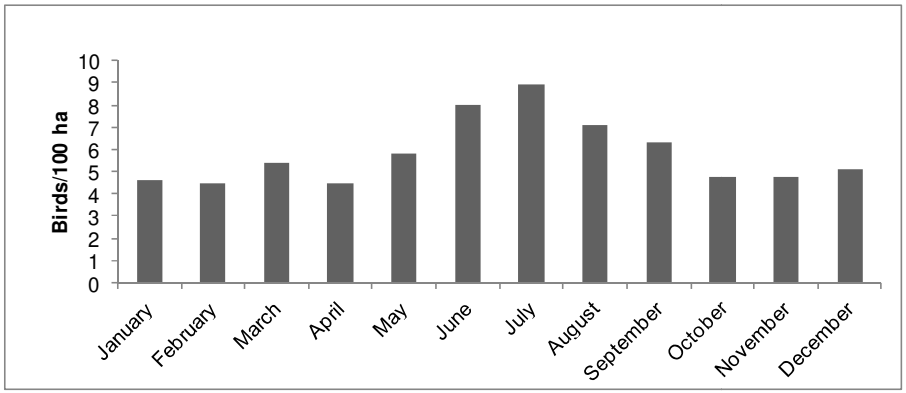

Figure 51b – Black-headed Oriole, seasonality

Breeding occurs mainly from September to December (Hockey et al. 2005).

Rock Martin *Hirundo fuligula*

At least some birds were present throughout the year, and nesting took place in summer on buildings in the commercial part of Groenkloof. The observed densities reached a peak in September of 2009 and otherwise showed great variability (Figure 52a).

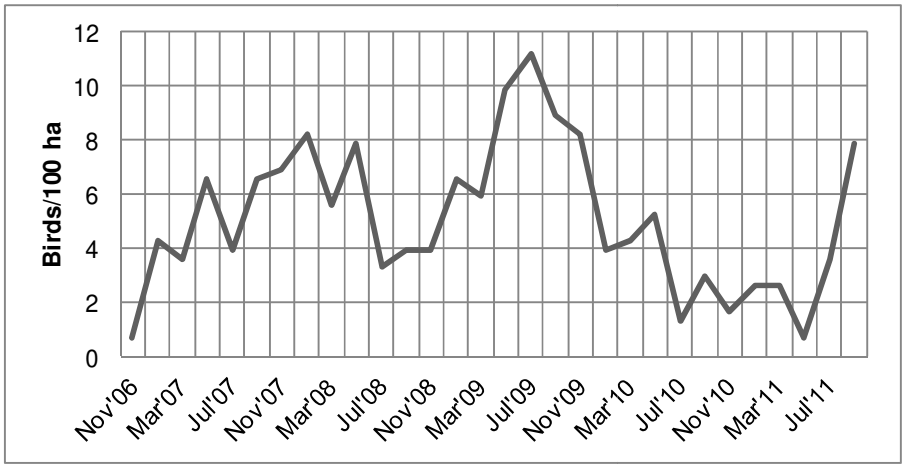

Figure 52a – Rock Martin, observed densities 2006-2011

There does not appear to be a seasonal pattern to the influxes and exoduses (Figure 52b). Reporting rate data on a regional scale show no seasonal variation in reporting rates apart from a slight decline in February – March (Harrison et al. 1997).

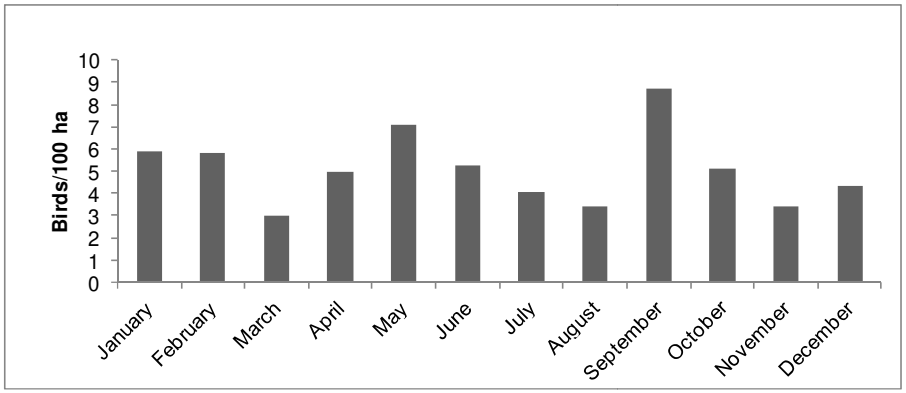

Figure 52b – Rock Martin, seasonality

Breeding takes place mainly from September to December (Hockey et al. 2005).

Cape Wagtail *Motacilla capensis*
The Cape Wagtail is an uncommon resident with observed densities peaking in winter in most years (but not in 2011) (Figure 53a). It is commonly found in association with man-made habitats and is probably more numerous in Groenkloof now than it was before urbanisation.

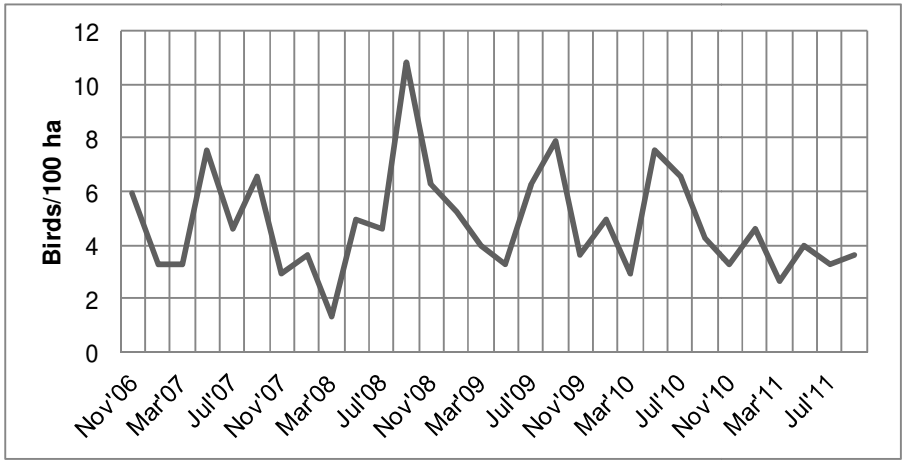

Figure 53a – Cape Wagtail, observed densities 2006-2011

It is regarded as resident in most of its range, but possibly an altitudinal migrant in places (Harrison et al. 1997). Cape Wagtails forage on the ground and are not thought to be subject to seasonal changes in conspicuousness. The winter peaks therefore probably represent an influx of birds from drier areas beyond the suburbs, or of altitudinal migrants from the Drakensberg escarpment (Figure 53b). They are known to congregate at communal roosts in some areas (Hockey et al. 2005), but no such congregations were observed within the study area (No more than 2 birds were seen together at any time).

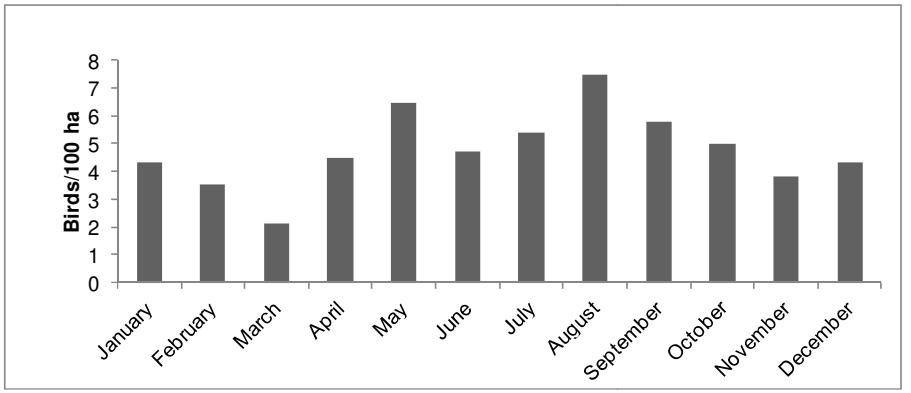

Figure 53b – Cape Wagtail, seasonality

Breeding occurs mainly from August to December (Hockey et al. 2005).

African Grey Hornbill *Tockus nasutus*
At least some birds are breeding residents within the study area (possibly two or three pairs). In addition, there appear to be non-breeding flocks which pass through the study area from time to time. The largest observed flock was of 18 birds moving through Groenkloof on 10 July 2007 (Figure 54a).

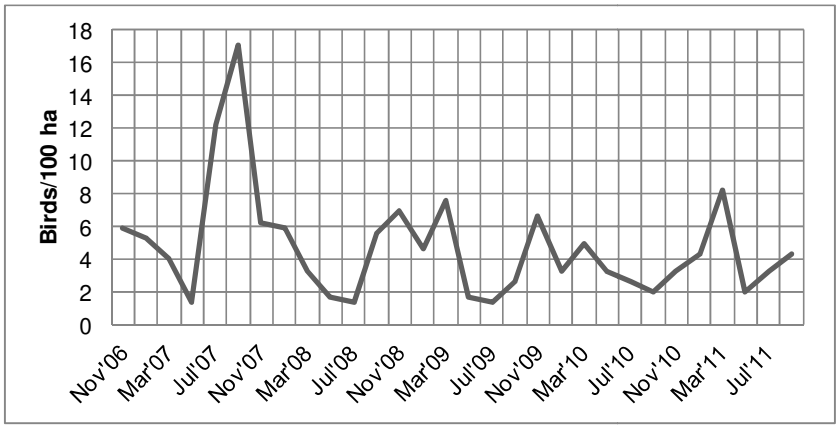

Figure 54a – African Grey Hornbill, observed densities 2006-2011

Although there is a tendency for higher numbers in summer, the seasonal pattern is not consistent and suggests nomadic movements by non-breeding birds (Figure 54b). It is thought to be migratory in parts of its range but the evidence for migration is not conclusive (Harrison et al. 1997). It is mainly a winter visitor elsewhere in Pretoria (F Peacock, E Marais pers. comm.).

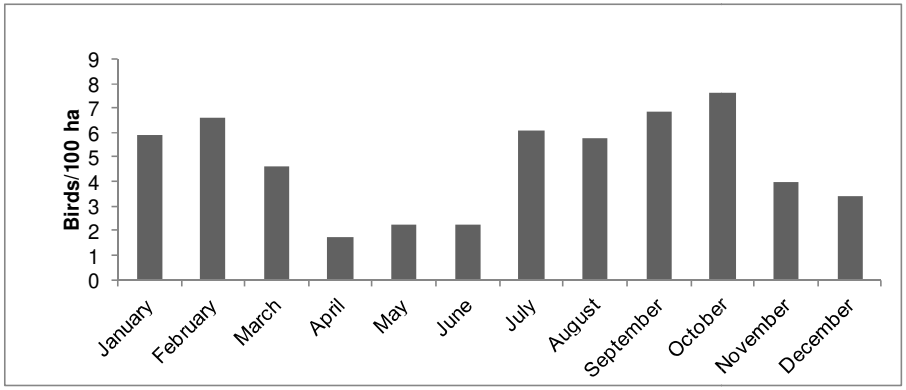

Figure 54b – African Grey Hornbill, seasonality

Breeding occurs mainly in October and November (Hockey et al. 2005).

Black-throated Canary *Crithagra atrogularis*

The numbers observed showed a sharp increase towards the end of the study period (Figure 55a). A sharp increase in numbers has also been reported in the suburb of Centurion to the south of Groenkloof early in 2012 (E. Marais pers. comm.).

There is a strong indication of seasonal movements, but these are possibly only over short distances. Although the birds tend to disappear from the study area in autumn (April to June), they are still present in the natural grasslands of the nearby undeveloped areas at that time, and may move there from the suburbs in order to exploit the seasonal abundance of natural grass seeds. Bird atlas data on a regional scale do not show significant seasonality in reporting rates (Harrison et al. 1997).

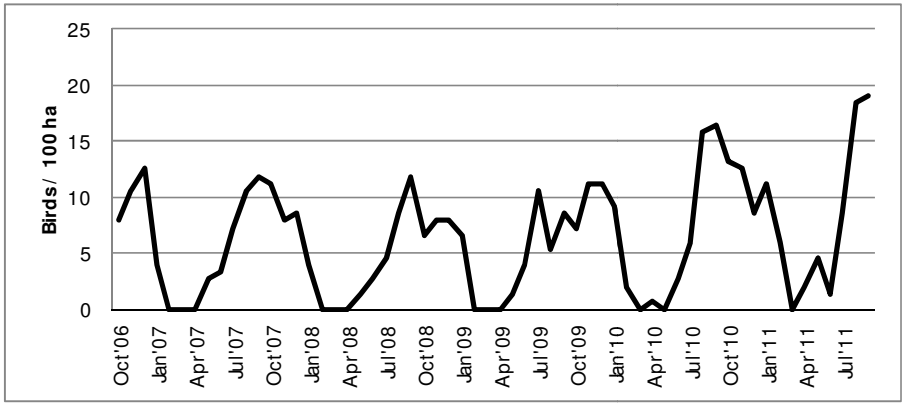

Figure 55a – Black-throated Canary, observed densities 2006-2011

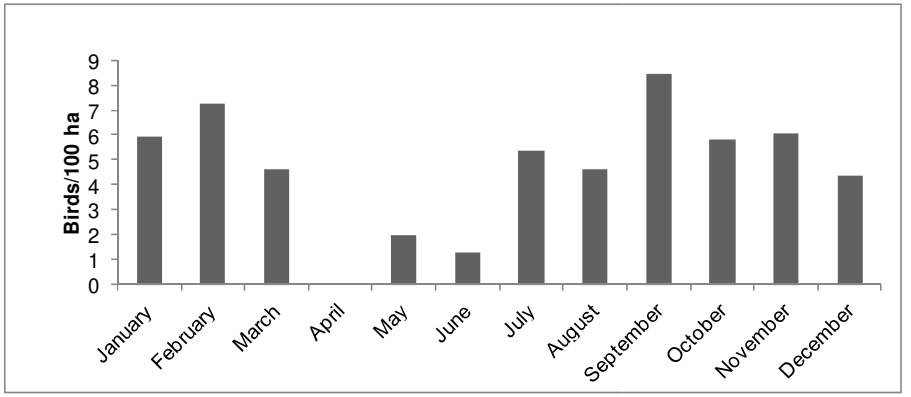

Figure 55b – Black-throated Canary, seasonality

Breeding was not observed within the study area and may take place mainly in the neighbouring undeveloped areas. Breeding occurs mainly from October to March (Hockey et al. 2005).

Brown-hooded Kingfisher *Halcyon albiventris*
The Brown-hooded Kingfisher is an uncommon resident in the study area. The observed densities peaked in August of 2009, with a lesser peak in January of 2010, but in general there was no regularity to the fluctuations in observed densities (Figure 56a).

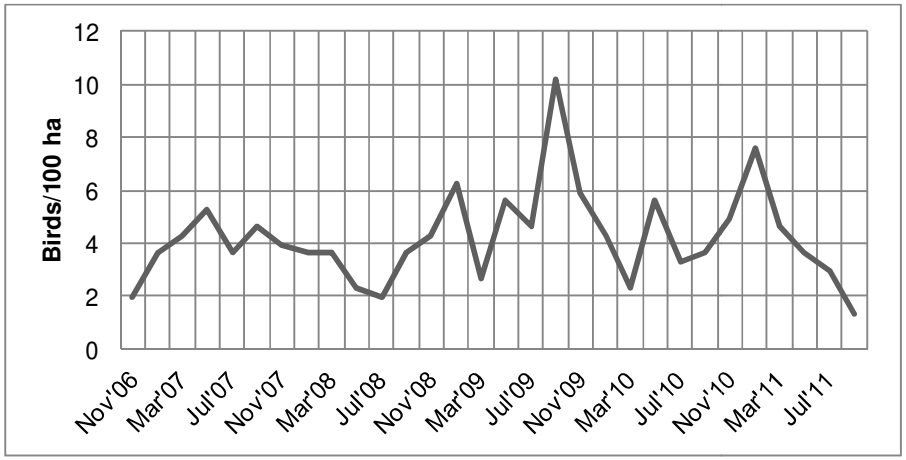

Figure 56a – Brown-hooded Kingfisher, observed densities 2006-2011

Observed densities were slightly higher in summer, but the difference is too small to be significant (Figure 56b). Bird atlas data on a regional scale show a slight peak in reporting rates in mid-winter (Harrison et al. 1997).

Nests are placed in tunnels in earth-banks. It is unlikely that suitable nest sites are found in suburban gardens, and breeding probably takes place in the Austin Roberts Bird Sanctuary and the Eugene Marais Park, where earth-banks are found. Breeding occurs mainly from October to December (Hockey et al. 2005).

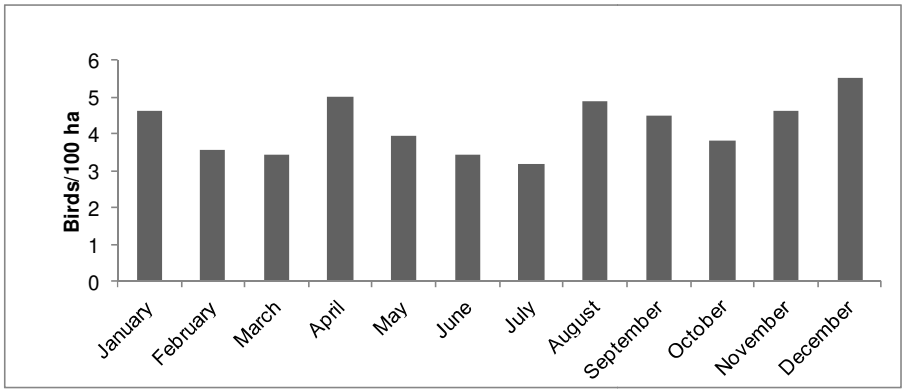

Figure 56b – Brown-hooded Kingfisher, seasonality

African Paradise-Flycatcher *Terpsiphone viridis*
The African Paradise Flycatcher is a breeding summer migrant which spends the winter further north in Africa. The observed numbers were lower in the summer of 2009/10, but were fairly constant in the other years (Figure 57a).

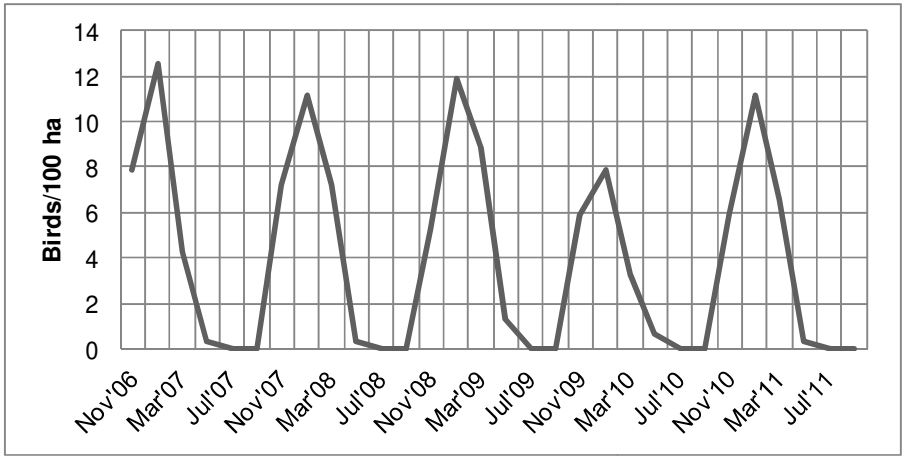

Figure 57a – African Paradise-Flycatcher, observed densities 2006-2011

Arrivals begin from 1 October each year and departure takes place gradually until 19 April. Between late arrivals and early departures, it

would appear that the full population is only present for three months (November to January) (Figure 57b).

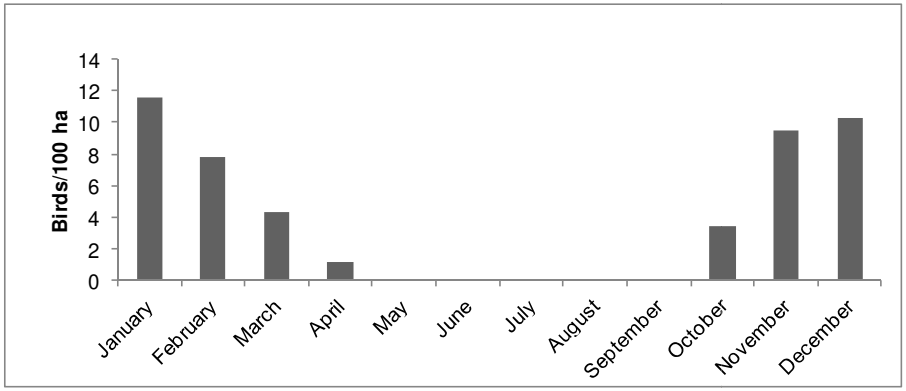

Figure 57b – African Paradise-Flycatcher, seasonality

Burchell's Coucal *Centropus burchellii*
A breeding resident. This is a skulking species, more often seen than heard. Consequently, changes in observed densities may relate to calling frequency at least as much as to the numbers present (Figure 58a).

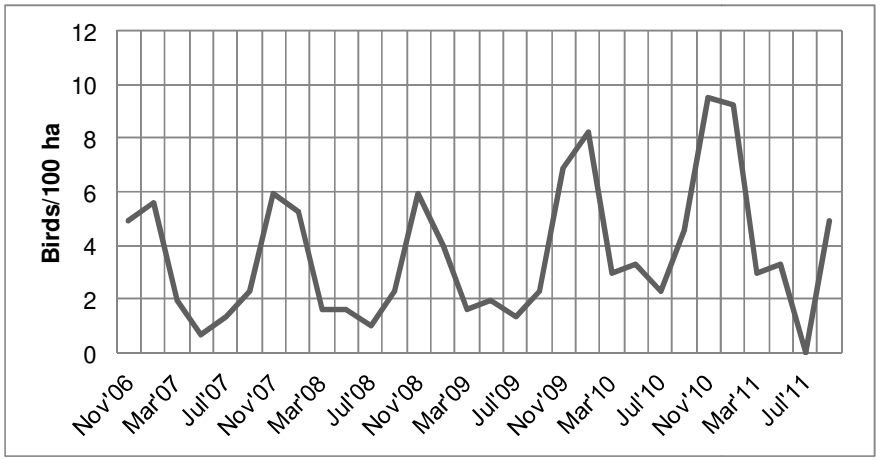

Figure 58a – Burchell's Coucal, observed densities 2006-2011

No seasonal movements are suspected, and the winter drop in observed densities indicates that it is mostly silent during winter (Figure 58b).

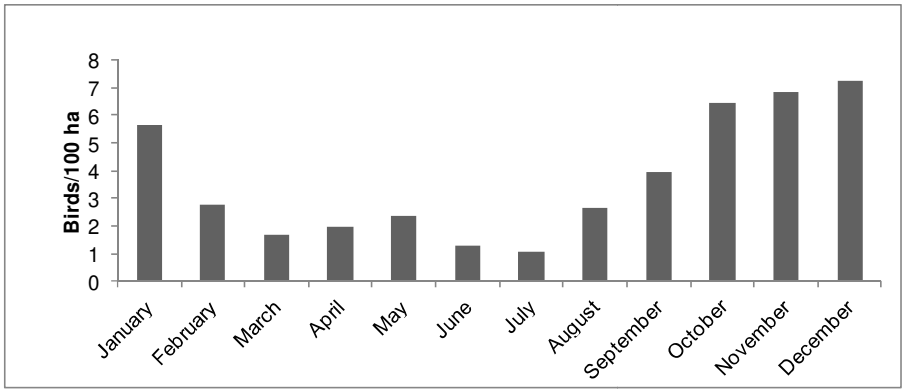

Figure 58b – Burchell's Coucal, seasonality

Breeding occurs from September to February (Hockey et al. 2005).

Spotted Thick-knee *Burhinus capensis*
A breeding resident which is most active at night. The birds moved about within the study area between favoured day-roost sites. Communal roosting has been reported in some areas (Hockey et al. 2005) but within the study area, no more than three adults were seen together at any time.

The observed densities were partly influenced by whether or not the active roost sites coincided with transect routes. Nevertheless, there was a regular drop in observed densities in autumn (March to April) (Figure 59a,b). No seasonal movements are suspected. Bird atlas data on a regional basis show no seasonal fluctuations in reporting rates (Harrison et al. 1997).

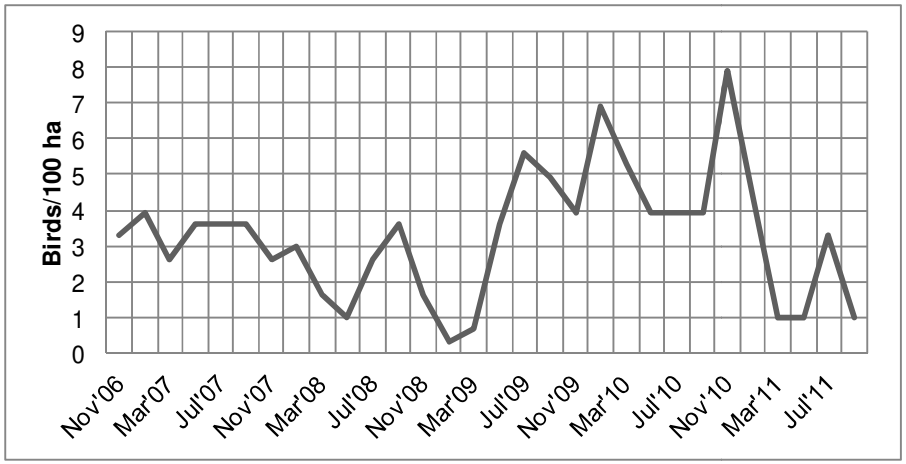

Figure 59a – Spotted Thick-knee, observed densities 2006-2011

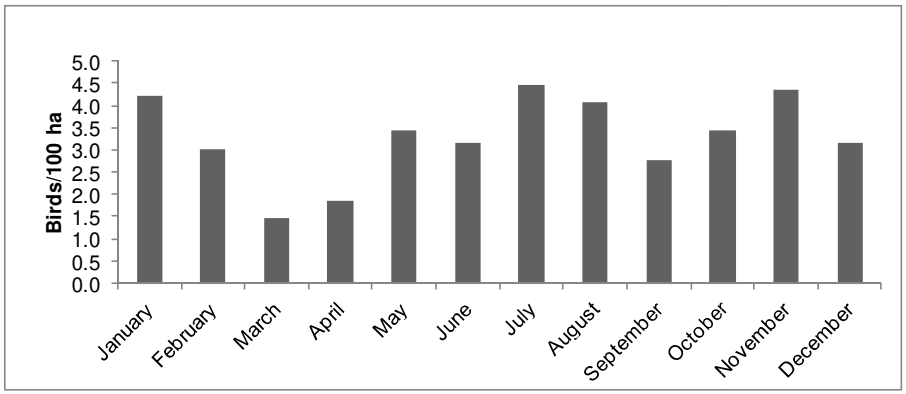

Figure 59b – Spotted Thick-knee, seasonality

Breeding occurs mainly from September to December (Hockey et al. 2005).

Red-throated Wryneck *Jynx ruficollis*

The Red-throated Wryneck was an uncommon resident for most of the study period, but it seemed to have disappeared from the study area by the end of the period (Figure 60a). It was seen only in and around the Cilliers Park and was last seen at the end of June 2011. There were probably no more than two breeding pairs present at any time. The preferred habitat of the species is a savannah with expanses of short grass. It would appear that lawns in suburban gardens are generally not extensive enough to accommodate the species. It occurs in the undeveloped areas neighbouring the study area and may re-colonise the study area in future. It has apparently been absent for some years from Elardus Park in the south-east of Pretoria, where it used to be resident (F Peacock pers. comm.).

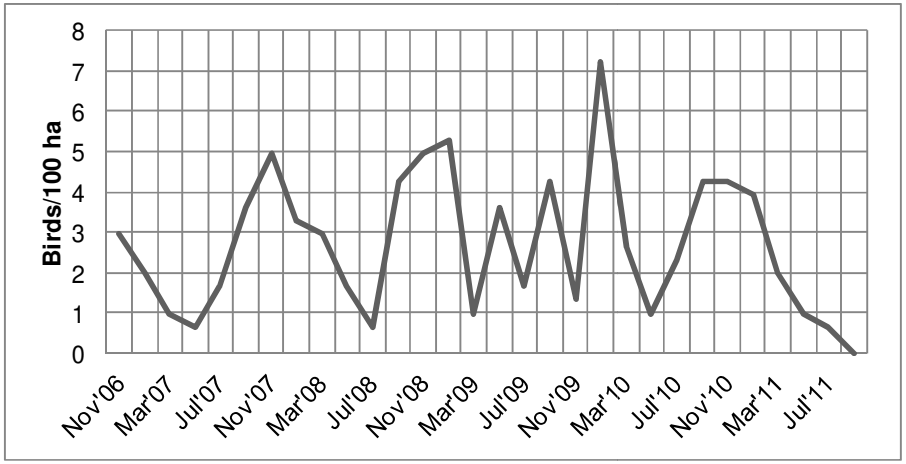

Figure 60a – Red-throated Wryneck, observed densities 2006-2011

The lower observed densities in winter probably reflect lower frequency of calling and hence reduced conspicuousness (Figure 60b). Bird atlas data on a regional scale reveal no seasonal fluctuations in reporting rates (Harrison et al. 1997).

Breeding occurs from August to February (Hockey et al. 2005).

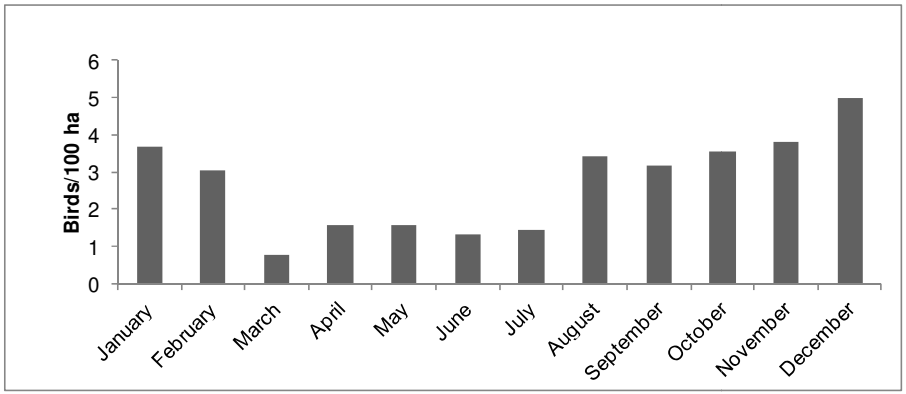

Figure 60b – Red-throated Wryneck, seasonality

Diderick Cuckoo *Chrysococcyx caprius*

A breeding summer migrant which spends the winter further north in Africa. Most birds are present for no more than four months of the year, between 9 October and 25 February (Figure 61a). The numbers observed increased from 2006 to 2009 and dropped off in the summer of 2010/11.

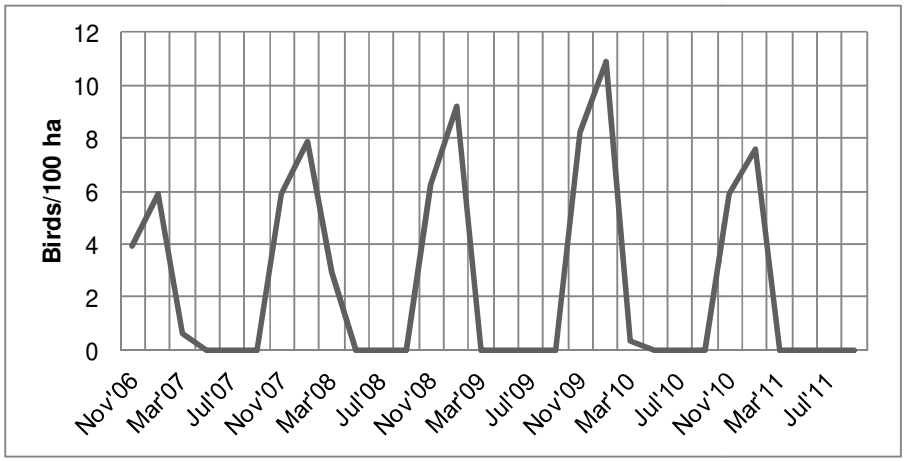

Figure 61a – Diderick Cuckoo, observed densities 2006-2011

The lower observed densities in January are mostly due to reduced conspicuousness when the birds are not calling (Figure 61b).

Breeding occurs in November and December. It is a brood parasite and the probable host species in the study area are the Southern Masked-Weaver and the Southern Red Bishop.

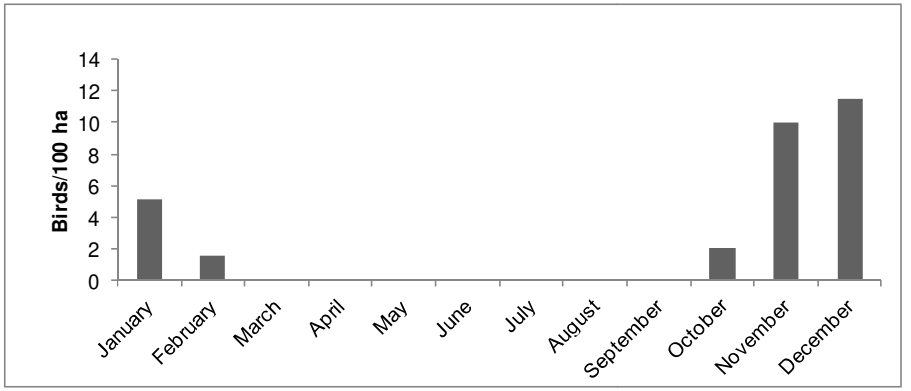

Figure 61b – Diderick Cuckoo, seasonality

Common Waxbill *Estrilda astrild*

The Common Waxbill was present regularly only in rank vegetation around wetlands in the Austin Roberts Bird Sanctuary. It was seen in flocks of up to 16 birds. Elsewhere in the study, it was seen only occasionally in groups of no more than four birds.

There appear to have been large influxes in March and April of 2007 and 2008, and at other times it was not continuously present (Figure 62a). It probably moves over short distances to other wetland areas in the vicinity of the study area and no long range seasonal movements are suspected (Figure 62b). Bird atlas data on a regional scale show minimal seasonal fluctuations in reporting rates (Harrison et al. 1997).

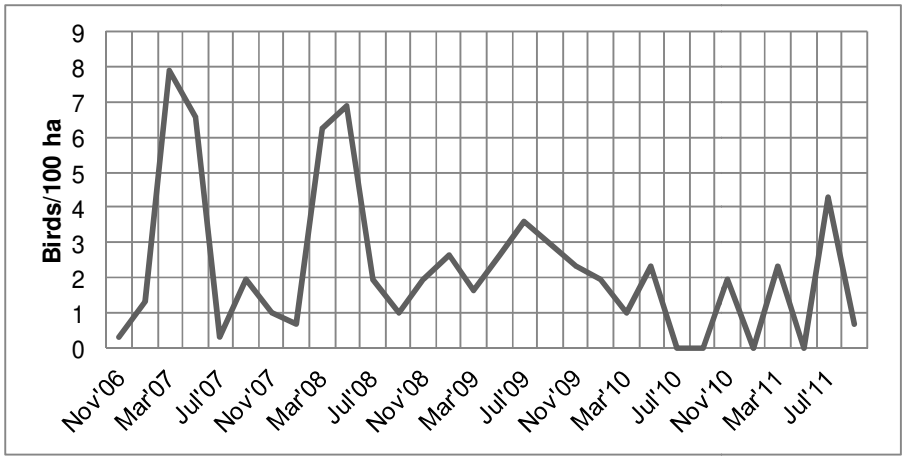

Figure 62a – Common Waxbill, observed densities 2006-2011

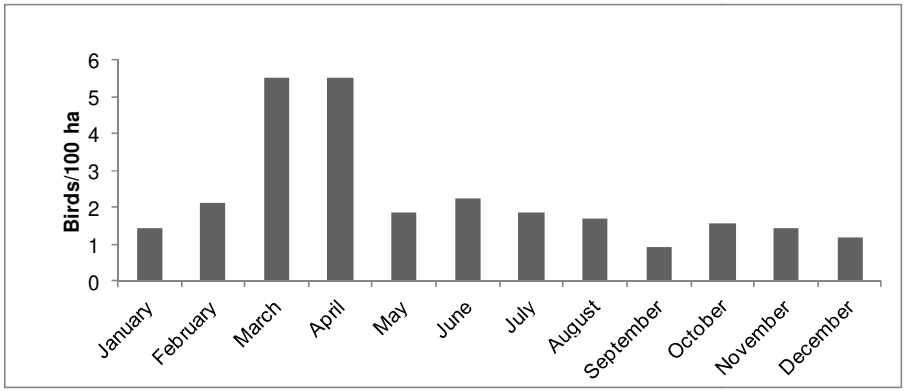

Figure 62b – Common Waxbill, seasonality

Breeding was not confirmed within the study area, but probably occurred. Breeding takes place mainly from December to February (Hockey et al. 2005).

Pin-tailed Whydah *Vidua macroura*

An uncommon resident. Males are highly conspicuous when in breeding plumage. They were seen singly or accompanied by two or three females. Numbers peaked in the summer of 2007/8, and appear to have declined since then (Figure 63a).

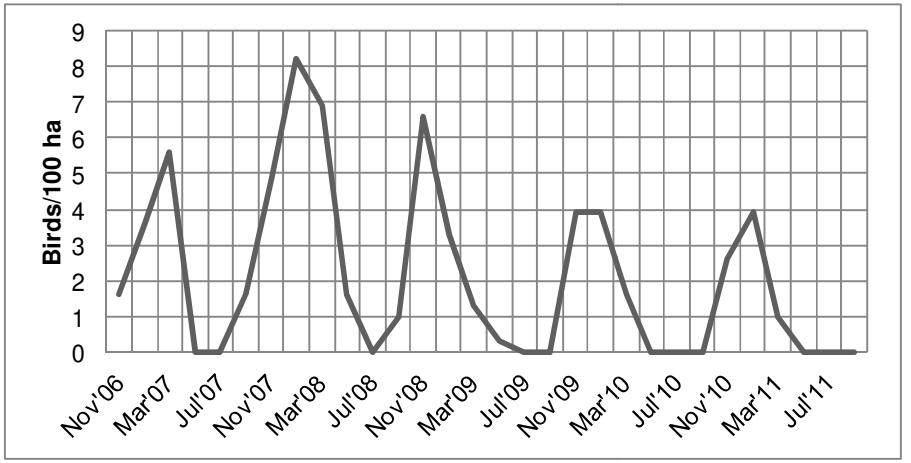

Figure 63a – Pin-tailed Whydah, observed densities 2006-2011

They were probably present throughout the winter, when the non-breeding plumage makes them extremely inconspicuous (Figure 63b).

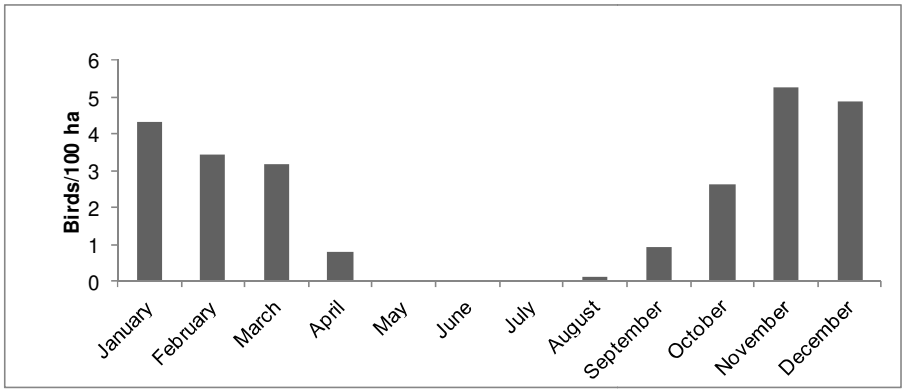

Figure 63b – Pin-tailed Whydah, seasonality

The Pin-tailed Whydah is a brood parasite, and the Common Waxbill is thought to be the most regular host (Hockey et al. 2005). Within the study area, the ranges of the Pin-tailed Whydah and the Common Waxbill do not correspond closely. Common Waxbills were only seen regularly in the southernmost corner of the area and were not continuously present. On the other hand, Pin-tailed Whydahs were present and performed territorial displays throughout the study area. The range of the Pin-tailed Whydah within the study area corresponds much more closely with that of the Bronze Mannikin, and that species may be the principal host here. Territorial displays take place from November to February, and this probably coincides with the breeding season.

Cardinal Woodpecker *Dendroscopus fuscescens*
The Cardinal Woodpecker is a breeding resident and appeared to increase in numbers from September 2007 to the end of the study period (Figure 64a).

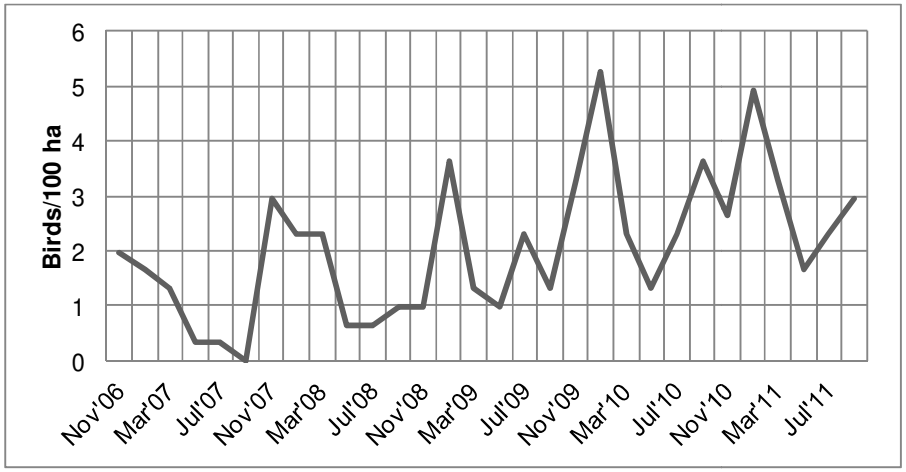

Figure 64a – Cardinal Woodpecker, observed densities 2006-2011

The low observed densities in winter may be due to reduced vocalisations and consequently reduced conspicuousness, as well as short range movements out of the study area (Figure 64b). No long range seasonal movements are suspected. Bird atlas data on a regional scale show only minimal seasonal fluctuations in reporting rates.

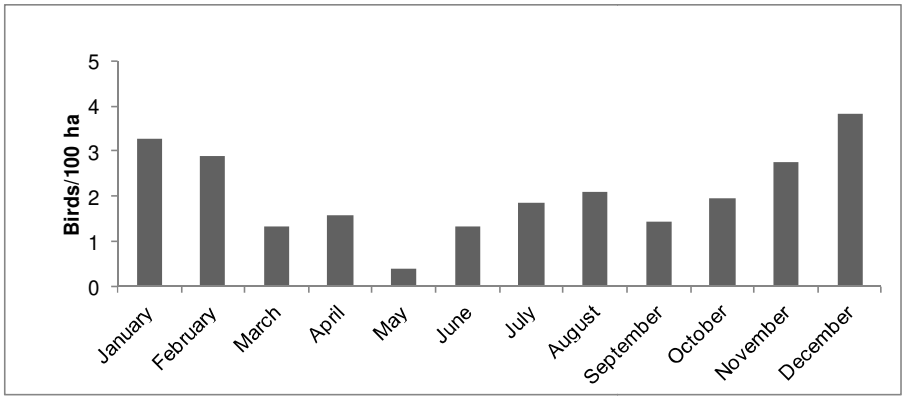

Figure 64b – Cardinal Woodpecker, seasonality

Egg-laying takes place mainly from August to October (Hockey et al. 2005). The mid-summer peaks in observed densities may reflect the presence of newly fledged young.

Pied Crow *Corvus albus*
The Pied Crow is a non-breeding visitor to the study area. It is usually seen in ones and twos overhead, but occasionally in groups of up to ten birds (August 2008 and May 2009) (Figure 65a).

No long range seasonal movements are suspected. The frequency of observations was greatest from May to October, and this may reflect post-breeding dispersal (Figure 65b). Bird atlas data on a regional scale show a slight dip in reporting rates in January-February (Harrison et al. 1997).

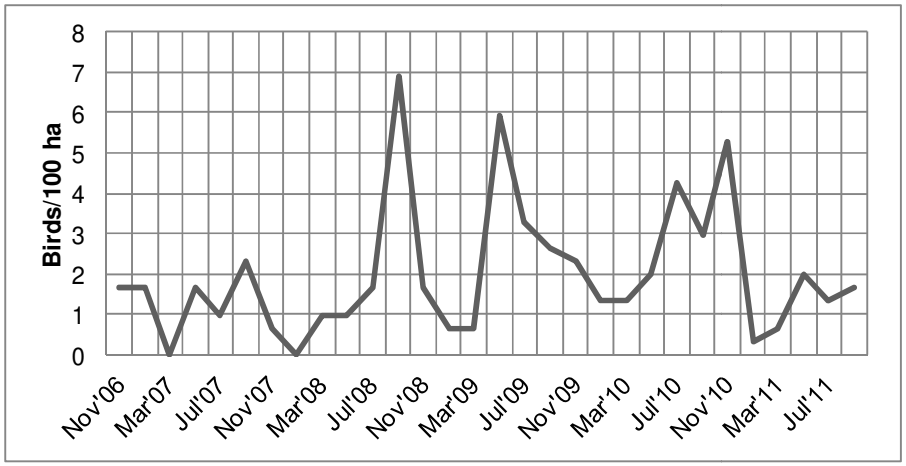

Figure 65a – Pied Crow, observed densities 2006-2011

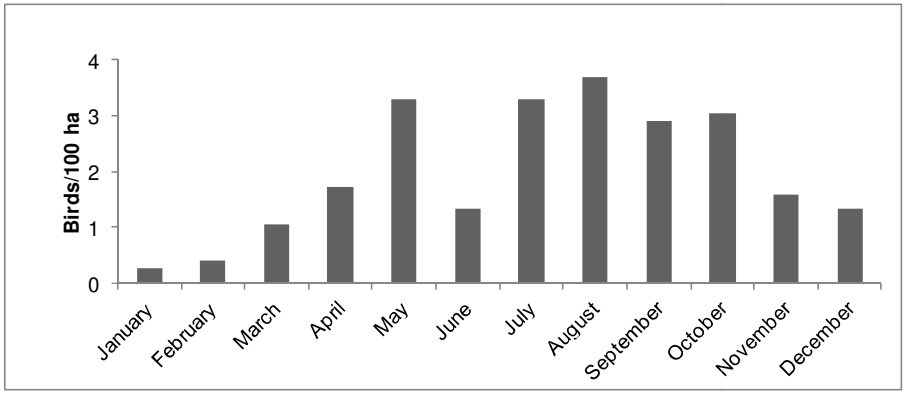

Figure 65b – Pied Crow, seasonality

Breeding probably takes place around the outskirts of Pretoria. The breeding season is mainly from July to January (Hockey et al. 2005).

Willow Warbler *Phylloscopus trochilus*

The Willow Warbler is a non-breeding migrant from the Palearctic region. It was observed within the study area between 18 September and 10 April of each year (Figure 66a). It is inconspicuous and the variation in observed densities from year to year may be related more to variation in observation effort than to the numbers present.

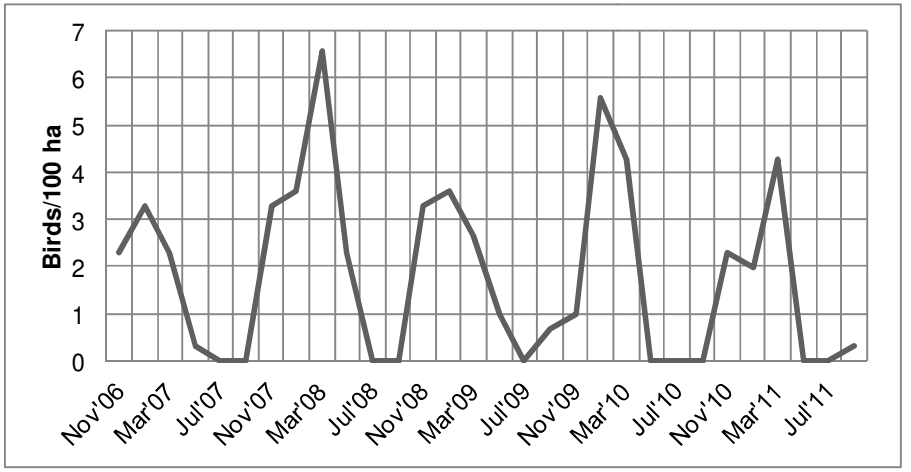

Figure 66a – Willow Warbler, observed densities 2006-2011

The observed densities peak in February, indicating that they are most vocal at that time (Figure 66b).

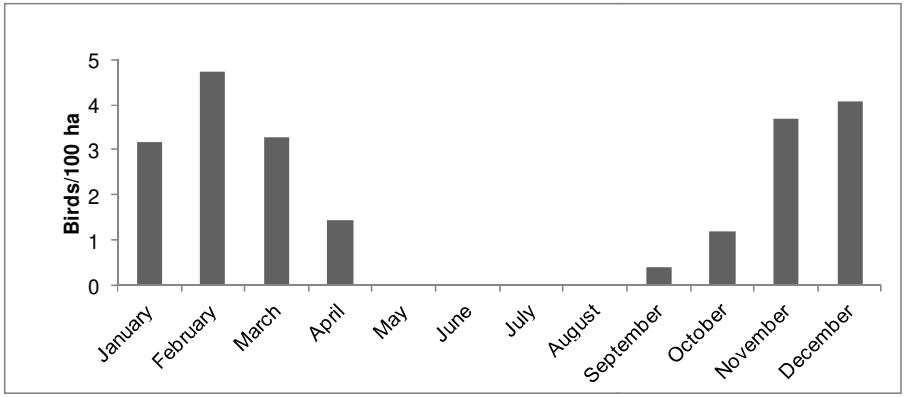

Figure 66b – Willow Warbler, seasonality

White-throated Swallow *Hirundo albigularis*
A breeding summer migrant which spends the winter further north in Africa. Apart from a single sighting in July 2011, they were present from 9 August to 25 March each summer (Figure 67a).

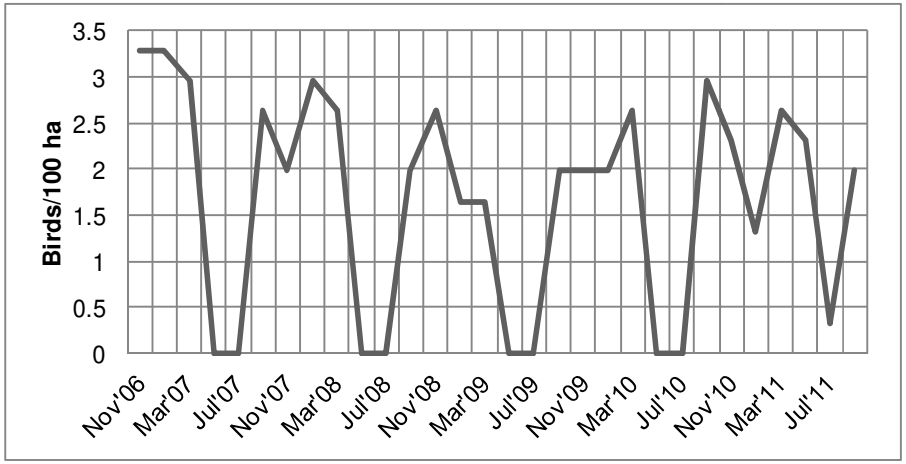

Figure 67a – White-throated Swallow, observed densities 2006-2011

There were no more than two breeding pairs present (Figure 67b). Most sightings were in the vicinity of wetlands at the Austin Roberts Bird Sanctuary and the Cilliers Park.

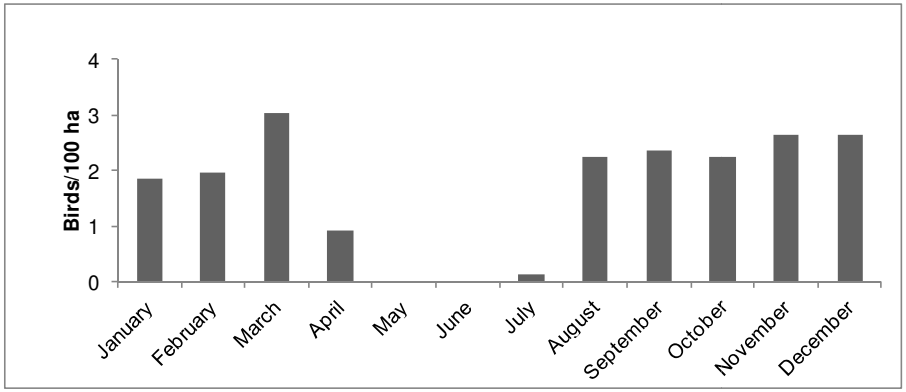

Figure 67b – White-throated Swallow, seasonality

Barn Swallow *Hirundo rustica*
A non-breeding summer migrant from the Palearctic region which was seen in the study area between 7 October and 7 April of each summer. The variation in numbers seen is probably mainly influenced by whether or not flocks passing through coincided with transect count times (Figure 68a).

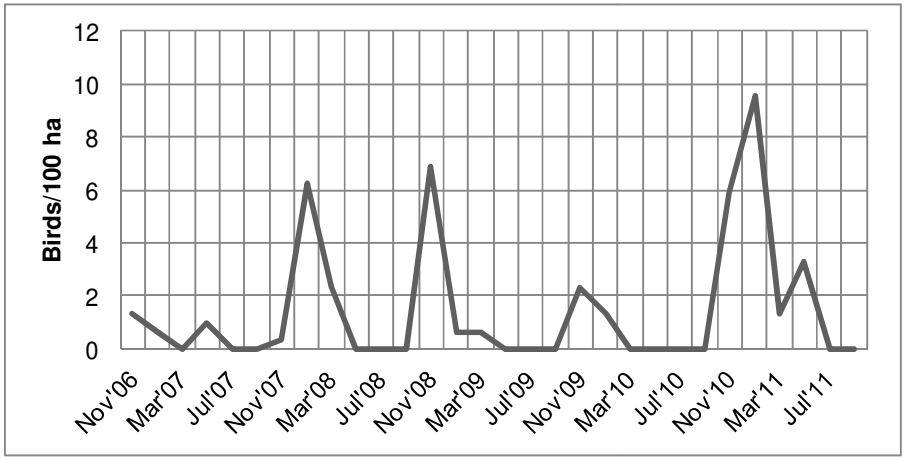

Figure 68a – Barn Swallow, observed densities 2006-2011

Although it is one of the most abundant species in the southern African region in summer, it is surprisingly scarce in Groenkloof. Whenever they were seen, they were travelling at speed, as if to exit from Groenkloof as quickly as possible. Occasionally, flocks were seen swirling about in the high winds ahead of an approaching storm.

The peak of observed densities in November and December may reflect arrivals from the Palearctic, heading further south. The low observed densities at the end of summer indicates that returning migrants take a different route (Figure 68b).

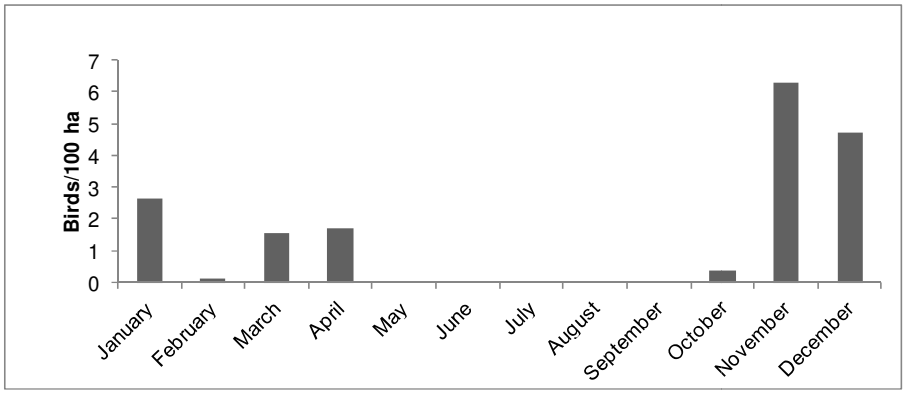

Figure 68b – Barn Swallow, seasonality

Spotted Flycatcher *Muscicapa striata*

A non-breeding summer visitor from the Palearctic. The numbers visiting the study area appeared to increase over the study period (Figure 69a).

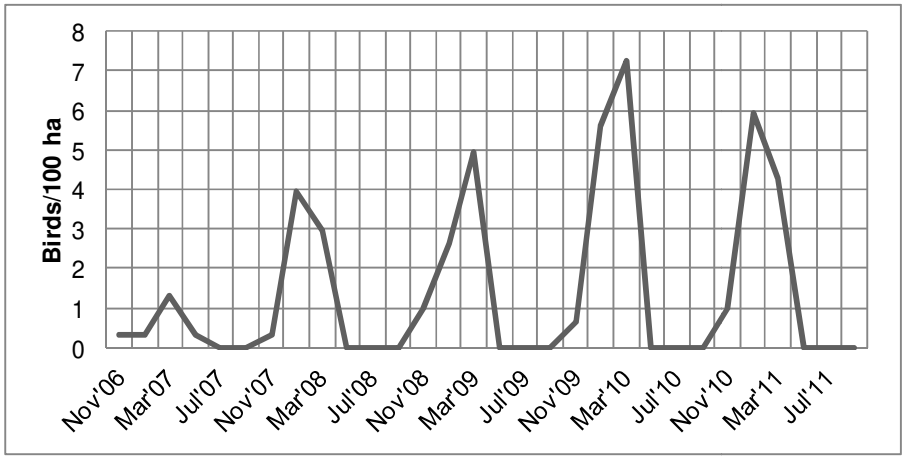

Figure 69a – *Spotted Flycatcher, observed densities 2006-2011*

They were observed between 8 November and 2 April each summer (Figure 69b). They were seen most often at the Cilliers and Eugene Marais Parks and seldom among private gardens.

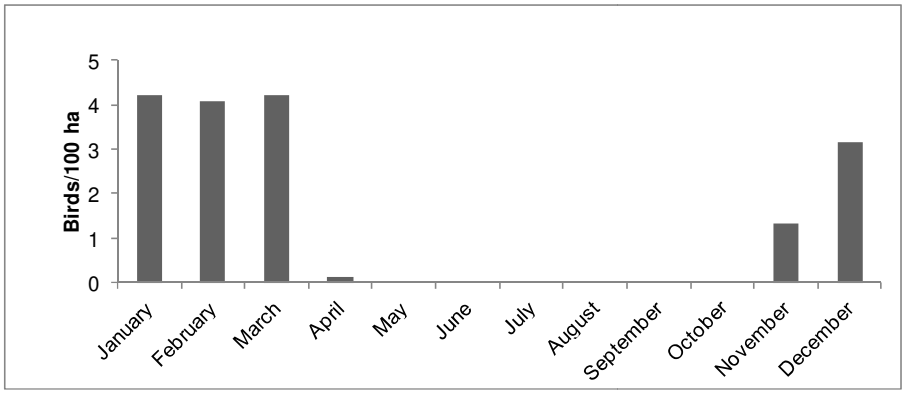

Figure 69b – Spotted Flycatcher, seasonality

Kurrichane Thrush *Turdus libonyanus*

The Kurrichane Thrush is a breeding resident in the undeveloped areas around Pretoria, and a non-breeding visitor (mainly in winter) to the study area (Figure 70a). In towns to the north of Pretoria, it is a common garden bird, but in Pretoria and towns to the south, it is replaced as a garden bird by the Karoo Thrush. It was seen most often near the Austin Roberts Bird Sanctuary, where extensive lawns are available, and rarely among private gardens.

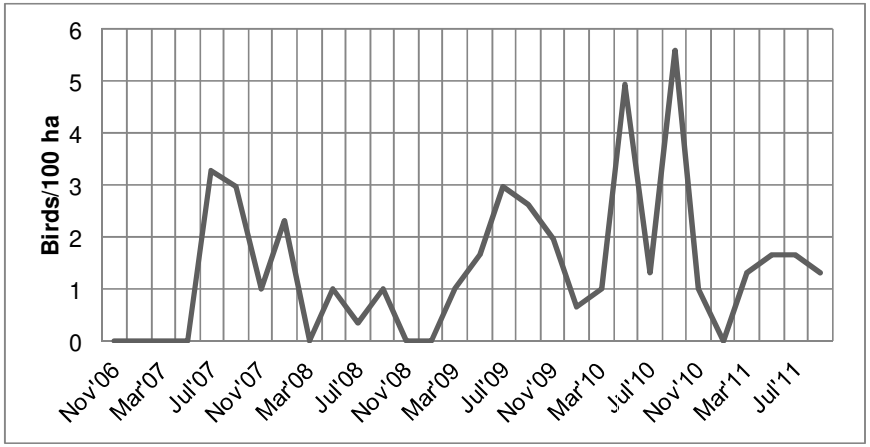

Figure 70a – Kurrichane Thrush, observed densities 2006-2011

Its occurrence in the study area may represent post-breeding dispersal of birds from the adjacent undeveloped areas (where the species was present throughout the year) (Figure 70b).

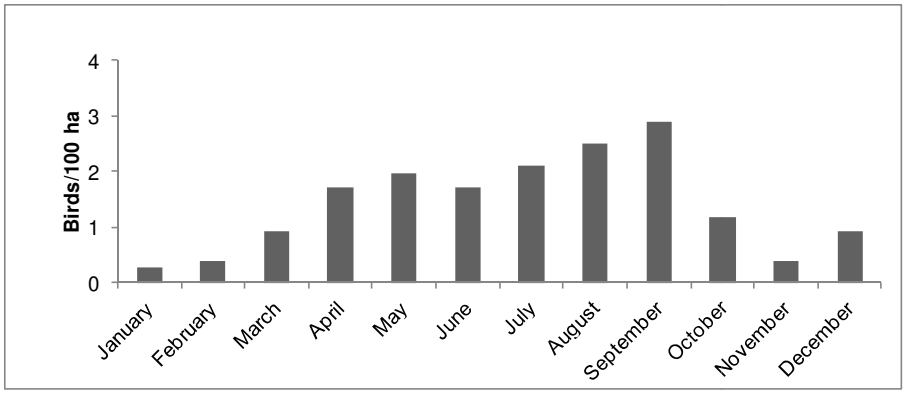

Figure 70b – Kurrichane Thrush, seasonality

Jameson's Firefinch *Lagonosticta rhodopareia*
Jameson's Firefinch was resident and probably breeding in the Eugene Marais Park and was not seen elsewhere in the study area (Figure 71a). The Eugene Marais Park is the only part of the study area which consists mainly of indigenous vegetation, including indigenous grasses. The population is probably continuous with that of the nearby undeveloped area, which is separated from the park by no more than 50 metres of residential property.

The winter peak in observed densities may represent post-breeding dispersal by birds from the undeveloped area (Figure 71b).

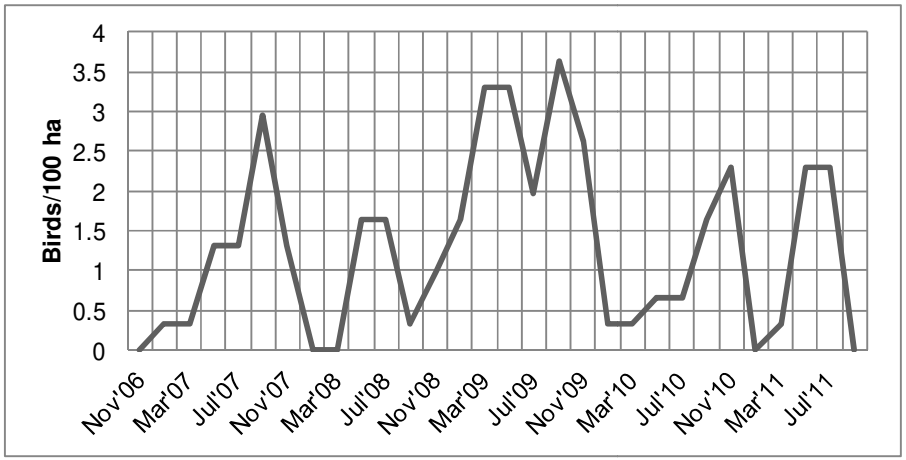

Figure 71a – Jameson's Firefinch, observed densities 2006-2011

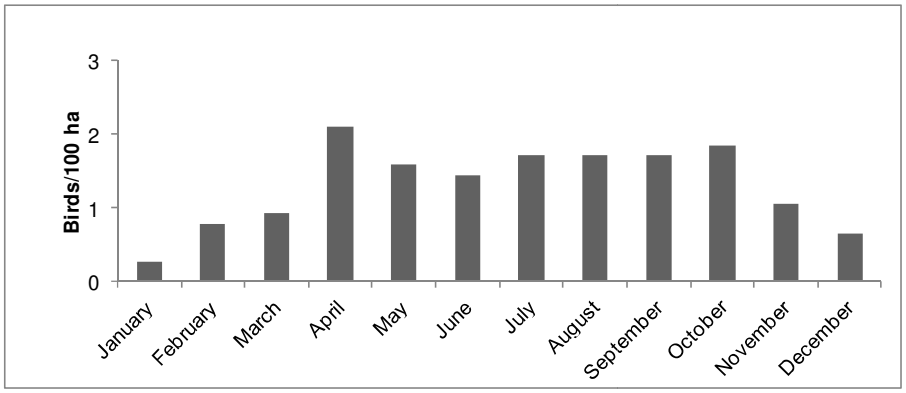

Figure 71b – Jameson's Firefinch, seasonality

Bar-throated Apalis *Apalis thoracica*
The Bar-throated Apalis was not observed during the first year of the study period, but since it occurred only at low densities at any time, it may have been overlooked initially (Figure 72a). Alternatively, it may have been temporarily absent. Given that it is common in woodland on the outskirts of the city, it is unlikely that it is new to the study area. Nevertheless, the population here appears to be increasing. E Marais (pers. comm.) reports that it colonised the suburb of

Centurion (to the south of Groenkloof) since 2009. It is also believed to be increasing in the south-east of Pretoria (F Peacock pers. comm.).

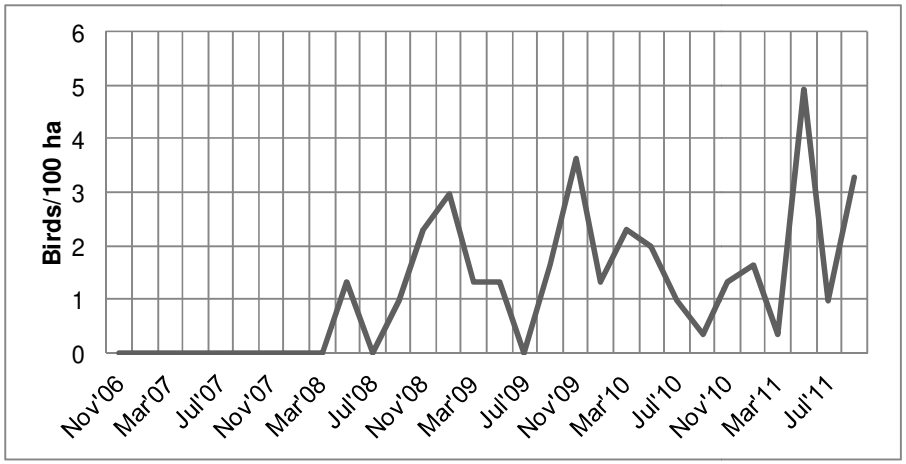

Figure 72a – Bar-throated Apalis, observed densities 2006-2011

The lower observed densities in March and July may reflect lower calling densities or movements to the neighbouring undeveloped areas (Figure 72b).

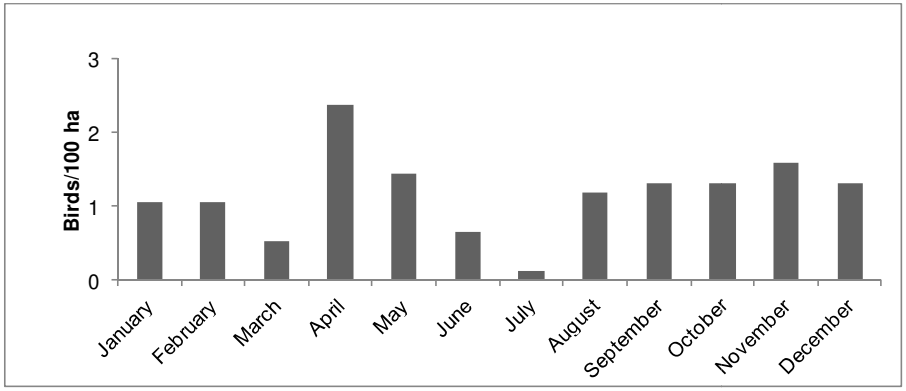

Figure 72b – Bar-throated Apalis, seasonality

Breeding occurs mainly from October to January (Hockey et al. 2005).

Woodland Kingfisher *Halcyon senegalensis*

A breeding intra-African summer migrant, observed between 14 November and 26 March. It was not observed during the summer of 2006/7, at least two pairs were present during the summer of 2007/8 (observed mostly at the Austin Roberts Bird Sanctuary and at the Cilliers Park) and probably only one pair in the succeeding summers (at the Austin Roberts bird sanctuary) (Figure 73a).

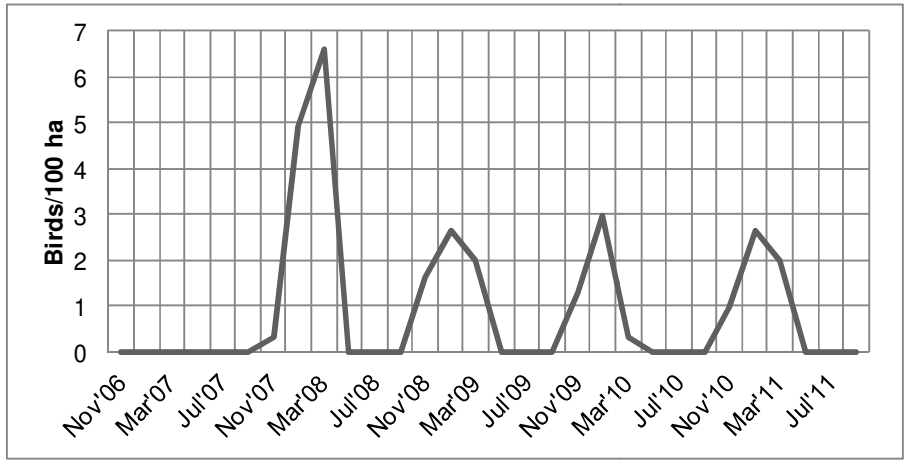

Figure 73a – Woodland Kingfisher, observed densities 2006-2011

Orange-breasted Bush-Shrike *Telophorus sulfureopectus*

A pair was present and possibly bred during the first three summers of the study period in the vicinity of the Eugene Marais Park (at the northern extremity of the study area, bordering an undeveloped area), and was not observed thereafter (Figure 74a).

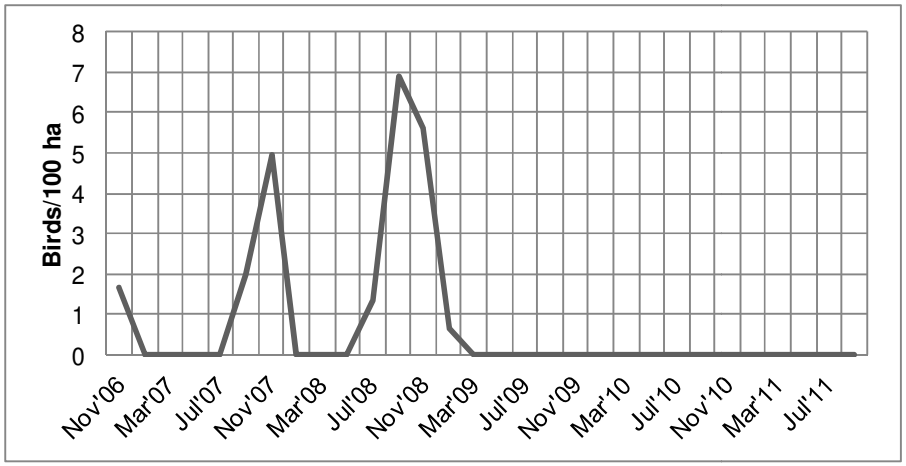

Figure 74a – Orange-breasted Bush-shrike, observed densities 2006-2011

Black-crowned Tchagra *Tchagra senegalus*

The Black-crowned Tchagra is a breeding resident in the neighbouring undeveloped areas and occasionally intrudes into the study area, mostly in the Eugene Marais Park, where it may breed (Figure 75a).

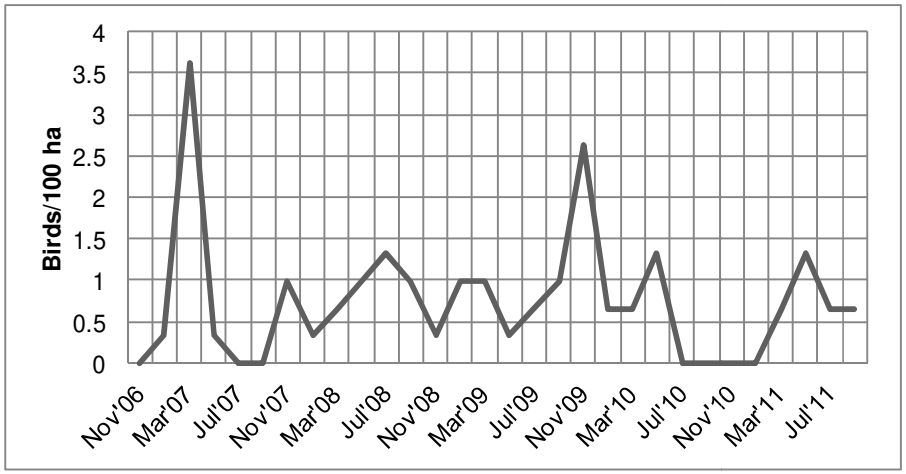

Figure 75a – Black-crowned Tchagra, observed densities 2006-2011

Grey-headed Bush-Shrike *Malaconotus blanchoti*

The Grey-headed Bush-Shrike was first observed in the study area in February 2009, has subsequently been encountered throughout the study area and appears to now be resident (Figure 76a). There is a superficial resemblance between the call of this species and the sound of the reverse hooter of an earth-moving vehicle. There was intensive road construction under way within the study area at the time of the first appearance of the bird. Did they move into Groenkloof with the hope of mating with some earth-moving equipment?

The species was also reported to invade the suburb of Centurion to the south of Groenkloof in 2009 and has been encountered regularly there since then (E Marais pers. comm).

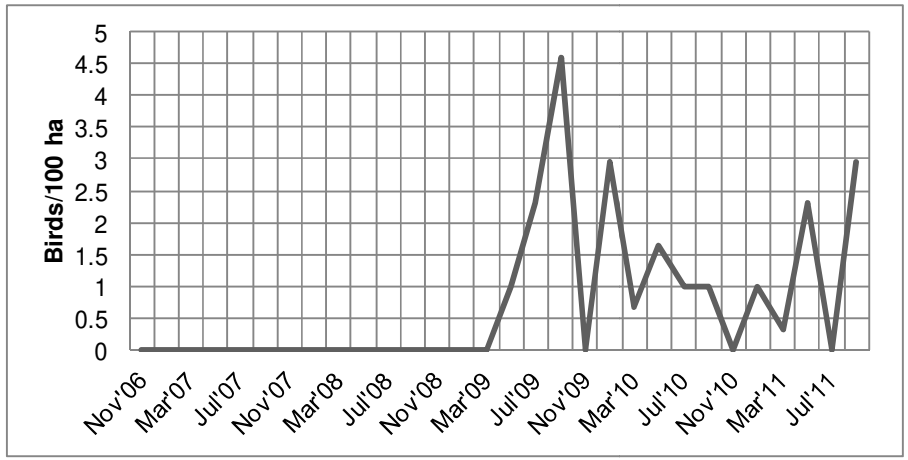

Figure 76a – Grey-headed Bush-Shrike, observed densities 2006-2011

Long-billed Crombec *Sylvietta rufescens*

The Long-billed Crombec is a breeding resident of the undeveloped woodland adjacent to the study area, and occasionally intrudes into the study area in and around the Eugene Marais Park, and possibly breeds there. The frequency of observation increased towards the end of the study period (Figure 77a).

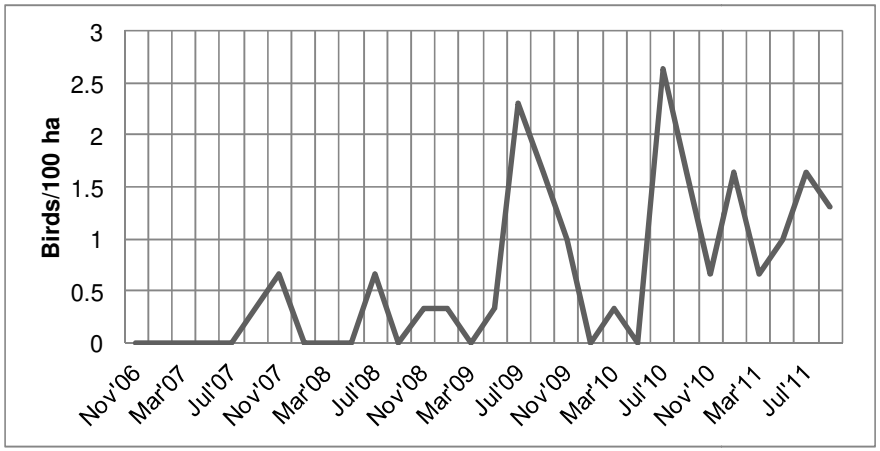

Figure 77a – Long-billed Crombec, observed densities 2006-2011

Fork-tailed Drongo *Dicrurus adsimilis*

The Fork-tailed Drongo is a resident of the mainly indigenous woodlands in the undeveloped areas adjacent to the study area. A few birds were present in the study area for most of the winter of 2007, but since then it made only occasional winter intrusions of short duration into the study area (Figure 78a). It was seen in ones and twos throughout the study area.

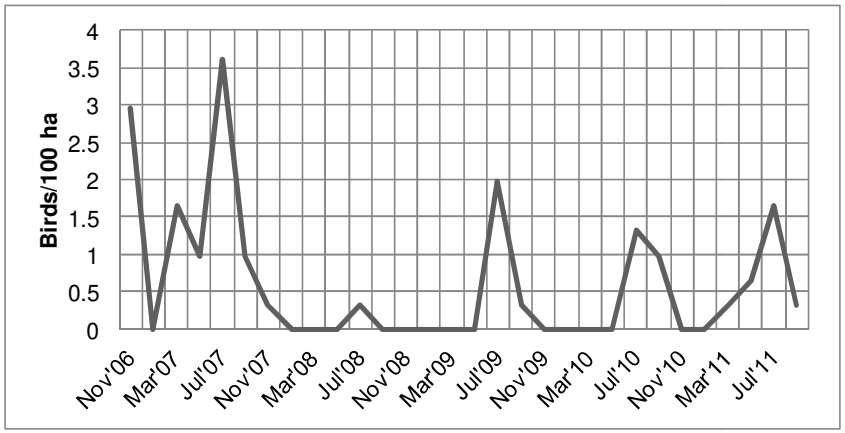

Figure 78a – Fork-tailed Drongo, observed densities 2006-2011

Groundscraper Thrush *Psophocichla litsitsirupa*

The Groundscraper Thrush is a resident of grassy verges in the undeveloped areas adjacent to the study area and an occasional visitor to the study area. It was seen most often in the expanse of lawns next to the Austin Roberts Bird Sanctuary and occasionally at other sites. In each year it made an appearance during the period October to December. In the first three years of the study period it appeared at several other times during the year, and in the final two years only during the October to December period (Figure 79a). No more than three birds were seen at any time. Breeding was not observed within the study area but may have occurred. It is attracted to newly mowed or newly burnt grasslands. Apparently the suburban habitat does not provide extensive areas of suitable habitat consistently enough for it to be resident there.

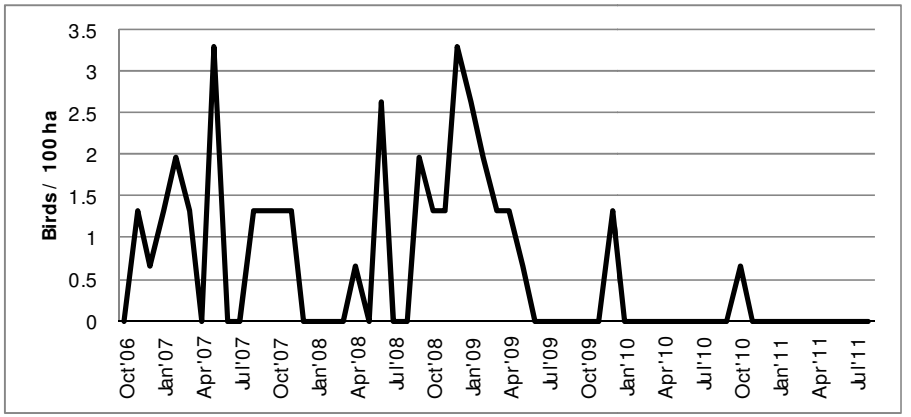

Figure 79a – Groundscraper Thrush, observed densities 2006-2011

Red-chested Cuckoo *Cuculus solitarius*

A breeding intra-African summer migrant. It is a skulking species and tends to be overlooked when not calling. The period during which it was observed (between 10 October and 13 January) reflects the period during which it was calling and it was probably present but silent for some time before and after the reported period. The lower observed densities in 2006/7 and 2010/11 (Figure 80a) indicate that fewer birds were calling (and breeding) and not necessarily that fewer birds were present. It is a brood parasite and the principal host species in this area is believed to be the Cape Robin-Chat (Hockey et al. 2005).

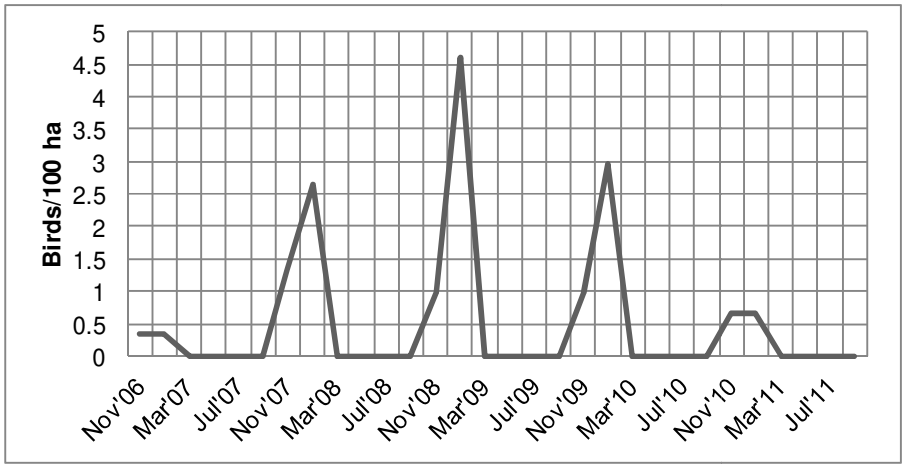

Figure 80a – Red-chested Cuckoo, observed densities 2006-2011

Golden-tailed Woodpecker *Campethera abingoni*

The Golden-tailed Woodpecker was observed sporadically throughout the year, but more often in summer than winter (Figure 81a). The majority of observations were at the southern end of the study area (the city end). The frequency and timing of observations is consistent with a population of one or more resident pairs whose home range coincides only partially with the study area.

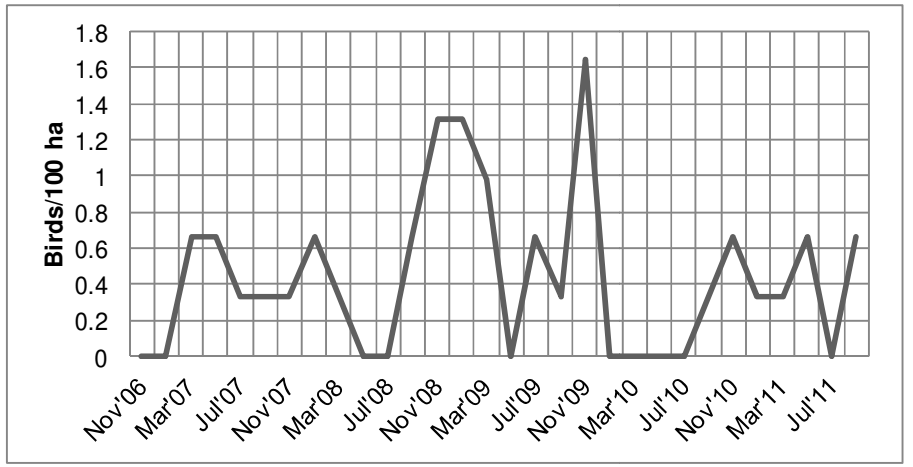

Figure 81a – Golden-tailed Woodpecker, observed densities 2006-2011

Klaas's Cuckoo *Chrysococcyx klaas*
Klaas's Cuckoo was not observed in the first three years of the study period but was observed several times between September and May of the last two summers (Figure 82a). It is inconspicuous when not calling, and may have been present but silent outside of the reported periods. It is a brood parasite and the White-bellied Sunbird and Bar-throated Apalis are the most likely hosts here. The Bar-throated Apalis, like Klaas's Cuckoo, was not observed in the study area in the first year of the study period.

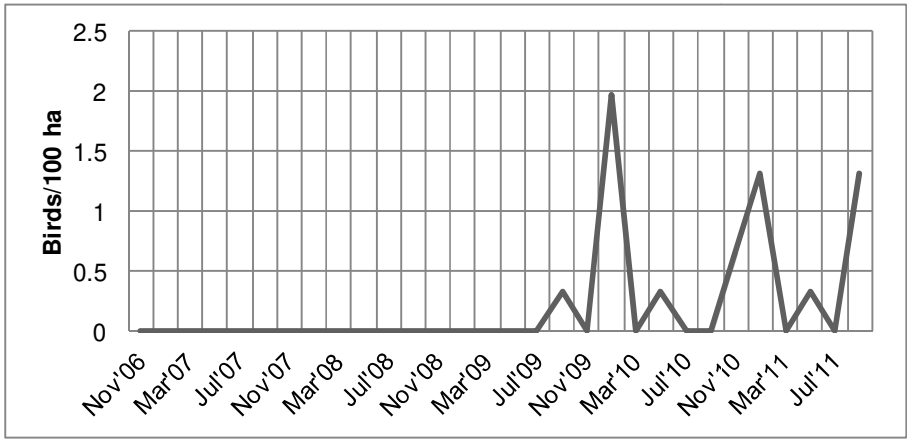

Figure 82a – Klaas's Cuckoo, observed densities 2006-2011

Other woodland birds
The following woodland species were occasional visitors to the study area. The number of observations of each was insufficient for conclusions about their status or movements to be drawn.

African Pied Wagtail	*Motacilla aguimp*
Alpine Swift	*Tachymarptis melba*
Barn Owl	*Tyto alba*
Black Cuckoo	*Cuculus clamosus*
Black Cuckooshrike	*Campephaga flava*
Black-chested Prinia	*Prinia flavicans*
Blue Waxbill	*Uraeginthus angolensis*
Brown-backed Honeybird	*Prodotiscus regulus*
Brown-crowned Tchagra	*Tchagra australis*
Brown-throated Martin	*Riparia paludicole*
Cattle egret	*Bubulcus ibis*
Chinspot Batis	*Batis molitor*
Cinnamon-breasted Bunting	*Emberiza tahapisi*
Common House-Martin	*Delichon urbica*
Fairy Flycatcher	*Stenostira scita*
Fiery-necked Nightjar	*Caprimulgus pectoralis*
Freckled Nightjar	*Caprimulgus tristigma*
Garden Warbler	*Sylvia borin*
Greater Honeyguide	*Indicator indicator*
Lesser Honeyguide	*Indicator minor*
Lesser Striped Swallow	*Hirundo Abyssinica*
Levaillant's Cuckoo	*Clamator levaillantii*
Malachite Sunbird	*Nectarinia famosa*
Marsh Warbler	*Acrocephalus palustris*
Neddicky	*Cisticola fulvicapillus*
Rattling Cisitcola	*Cisticola chinianus*
Red-billed Quelea	*Quelea quelea*
Red-headed Finch	*Amadina erythrocephala*
White-fronted Bee-eater	*Merops Bullockoides*
White-winged Widowbird	*Euplectes albonotatus*

Birds of prey
The following species were seen sufficiently frequently to be regarded as resident in the vicinity of the study area.

Ovambo Sparrowhawk	*Accipiter ovampensis*
Little Sparrowhawk	*Accipiter minullus*

The following species were observed only occasionally in the study area:

African Fish Eagle	*Haliaeetus vocifer*
African Goshawk	*Accipiter tachiro*
African Harrier-Hawk	*Polyboroides typus*

Amur Falcon	*Falco amurensis*
Black Sparrowhawk	*Accipiter melanoleucus*
Black-shouldered Kite	*Elanus caeruleus*
Gabar Goshawk	*Micronisus gabar*
Lanner Falcon	*Falco biarmicus*
Peregrine Falcon	*Falco peregrinus*
Steppe Buzzard	*Buteo buteo*
Yellow-billed Kite	*Milvus parasitus*

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