Population status of Sokoke Scops Owls *Otus ireneae* in the Arabuko-Sokoke Forest, Kenya

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Introduction

The Sokoke Scops Owl *Otus ireneae*, is an East African endemic that occurs mainly in the *Cynometra* woodland of the Arabuko-Sokoke Forest (ASF) in coastal Kenya. Since its discovery in 1965 (Ripley, 1966), two additional sub-populations were discovered; in 1992 a small population was discovered in the foothill forests of the east Usambara mountains in Tanzania (Evans *et al*., 1996) and in 2002, another small population was discovered in the Dakatcha woodlands, 30 km north of Arabuko-Sokoke forest (Colin Jackson and David Ngala pers. comm.). With a small and severely fragmented range within which suitable habitat is declining the species is currently listed as endangered in IUCN's Red data list of threatened species (Birdlife 2008). The ASF, the species' stronghold, covers an area of 372 km^2, of which only about 220 km^2 is suitable habitat. Poaching of timber trees particularly *Brachylaena huillensis* and *Pleurostylia africana* has significantly affected forest cover with negative impacts on biodiversity in the forest (Fanshawe 1994). The forest also faces habitat degradation threats from an increasing African Elephant *Loxodonta africana* population and ongoing illegal activities (Glenday, 2008). The greatest threat to the forest is however, human encroachment and long-standing threats to de-gazette parts of the forest for human settlement (Gordon and Ayiemba, 2003)

The ASF has been considered the second most important forest in Africa for bird conservation (Collar and Stuart 1985) The Sokoke Scops Owl population of the ASF has remained relatively stable at about 7 to 8 pairs since 1979 (Britton and Zimmerman, 1979; Kelsey and Langdon, 1984, Virani 1995, Virani, 2000) despite the escalation of threats and human population pressure. The Usambara population is estimated at densities of between 1.5 pairs/km^2 and 4 pairs/km^2 within an area of suitable habitat covering about 97km^2 (Evans 1997) while only eight individuals have been recorded at Dakatcha (David Ngala pers. comm.). Monitoring of this endangered species is therefore of utmost importance

especially since aspects of its breeding and longevity are unknown. In this paper, we present the results of Sokoke Scops Owl call surveys carried out in 2005 and repeated in 2008 and compare our findings with density estimates recorded in 1993 by Virani (2000).

Study Area and Methods

The ASF (39^{o} 59'E, 3^{o} 20'S) lies 110 km north of Mombasa city at the Kenyan coast. Call surveys of the species was conducted in the *Cynometra* woodland of the forest. This habitat type occurs in two separate regions of the forest with average canopy height ranging from 4 m in thickets to 15 m in forested areas (Virani, 2000; Kelsey and Langdon, 1984; Britton and Zimmerman, 1979). Owl monitoring transects were set up and geo-referenced at four major locations in the forest- Jilore, Kararacha, Dida and Nyari. Jilore, Kararacha and Dida consist of tall canopy *Cynometra* trees (15 m height) while at Nyari canopy height is approximately 7 m. Dida lies adjacent to a more densely populated human settlement and in 2002, a section of the forest in this area was selected for a pilot Participatory Forest Management (PFM) programme. This was aimed at encouraging the management of forest resources by local communities in partnership with the government.

Owl densities were estimated using the call-playback method as described by Kelsey and Langdon (1984) and used in 1993 by Virani (2000). One-minute-long owl calls were played at 200 m intervals (six points per transect) and all owl calls heard in the ensuing five minutes were recorded with reference to pitch (high or low), estimated distance of call, and bearing. Each high-pitched owl call was considered that of a territory holding male and hence representing a pair (Kelsey and Langdon 1984). Where two simultaneous calls - a high and low pitch duet were heard from within the same area, we considered this to also represent a pair of owls, as pairs usually duet in response to intruding calls (Virani 2000). Data from transects conducted on windy and rainy nights were discarded and only those conducted on calm clear nights were used in density calculations.

Sixty-seven transects (*Jilore*:26 transects; *Kararacha*:16 transects *Dida*: 13; *Nyari*:12) were surveyed during April and September 2005 while 34 transects (*Jilore*:11 transects; *Kararacha*:8 transects *Dida*: 8; *Nyari*:7) were surveyed during February and March 2008. The totals include twelve transects at Jilore and Kararacha used in the 1993 density surveys by Virani (1995). We assumed that owls responded to playback calls irrespective of the time of the night or the different stages of the moon. The maximum distance that an owl could be heard was 250 m (Virani 2000). Based on the number of calling pairs within a 1000 m by 500 m transect block, we calculated owl densities as pairs/km^2.

Results

Owl densities in the ASF recorded during 2005 and 2008 were not significantly different (Mean: 2005=6.14 ±3.31; 2008= 5.65 ±3.06; *Mann-Whitney test*: *U= 1040; P>0.05*). These densities were lower but not significantly different from those recorded in 1993 by Virani (1995) (Mean: 1993= 6.71 ±3.26; *Kruskal-Wallis test*: *H= 2.73; P>0.05*).

Owl densities were significantly higher at Jilore, Kararacha and Dida than at Nyari (*Kruskal-Wallis test*: H= 15.68; p=0.01; Table 1). However densities were consistently higher at Jilore than at any other site within the ASF throughout all the years (Table 1). Even though there were no significant density differences between years and between the sites, our data showed a steady decline in owl densities at all the sites between 1993 and 2008 (Figure 1). Owl density declined more at Kararacha than at any other site. Overall owl density declined from 7.1 in 1993 (Virani 1994) to 5.5 owls/km^2 in 2008.

Discussion

Although Sokoke Scops Owl densities have not changed significantly over a 16-year period, it is clear that over the same period they have declined by 22.5% in the ASF. This implies that the current population estimate of owl pairs in the ASF

is about 800 pairs, down from 1025 pairs estimated by Virani (2000). Of particular concern is that our observed overall density is much lower than the 7-8 pairs/km2 density estimated by Britton and Zimmerman (1979) and again by Kelsey and Langton (1984) using similar methods. Although the total forest area has not changed over the last 20 years (ASFMT 2002), illegal removal of trees (especially *Brachylaena huillensis* for carving wood) has continued albeit at different scales over the years (Kelsey and Langton 1984; Wairungu et al. 1993; Virani 1995; Glenday 2008). Evans (1997) has documented that severely modified or heavily degraded forests support lower densities of Sokoke Scops Owls. It is therefore plausible to infer that the overall population of Sokoke Scops Owls in the ASF is well below the current estimate of 800 pairs. The main threats to the ASF especially agricultural encroachment, charcoal production, illegal extraction of timber for wood-carving, building, firewood and illegal unsustainable game meat hunting still persist unabated (Thompson et al. 2007). This is despite the success of community-based projects such as the Kipepeo project (Gordon and Ayiemba 2003) and the formation of a local bird-guide association, which have provided financial incentives to the local communities. Proposals to de-gazette some parts of the forest around Kararacha to pave way for human settlement appear to have stalled but increases in human population density around the forest over the last five years has increased pressure on the forest and will invariably affect Sokoke Scops Owl populations (Gordon and Ayiemba 2003). Not surprisingly, this area of the ASF (Kararacha) has recorded the greatest owl population density decline.

Differences in owl densities between the four sites reflect the condition and structure of the forest and also human population pressure at the site. The surrounding areas within Nyari and Kararacha have higher human densities (ASMFT 2002) and lower open forest canopies than Jilore and Dida. The Jilore site inside the nature reserve is protected from human encroachment but the habitat comprises secondary growth forest and is vulnerable from destruction by elephants. There are fewer mature trees and scattered tree stumps at Jilore

recorded in the past (Virani 2000) indicating a high degree of human disturbance. The Dida site with highest owl densities during our surveys has also the lowest human densities around the ASF. It is also the site of pilot Participatory Forest Management project initiated in 2002 (ASFMT 2002).

Given the current declining population trends of the Sokoke Scops Owl in the ASF, urgent conservation action is required by the Kenyan government to help ensure that the species' status does not get raised to "critically endangered". Despite the considerable amount of funds allocated for the conservation of the ASF, illegal logging, clearing and degradation of the forest continues, much to the detriment of the Sokoke Scops Owl population and despite the forest's protected status over many decades. While future surveys are necessary to ensure that the species does not become locally extirpated, it might be worth considering extending the range of the species by releasing a few pairs of Sokoke Scops Owls in similar habitats. Given that the species may have historically ranged throughout the East African coast, an experimental release of a minimum of six pairs of owls should be conducted in the Kaya forests south of Mombasa where similar habitat occurs and no Sokoke Scops Owls have been recorded there (Virani et al., in prep). In addition future studies should focus on obtaining a better understanding of the species' breeding biology as this information may become necessary should the owl population size become unviable and captive restoration becomes the only species survival option.

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Table 1: Numbers of Sokoke Scops Owl pairs per km2 at various sites in 1993, 2005 and 2008 in the ASF.

Site	1993	2005	2008
Jilore	7.25	6.76	6.72
Kararacha	6.17	5.12	4.00
Dida PFM	no data	7.84	7.00
Nyari	no data	4.33	4.29

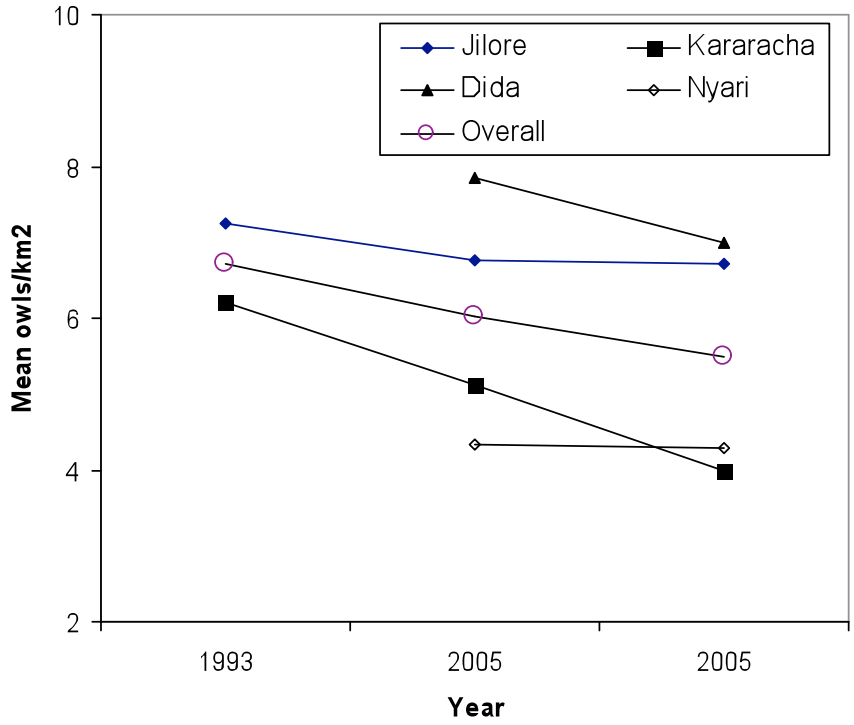

Figure 1: Linear population density trends of Sokoke Scops Owl pairs in the ASF