OSTRICH 2010, 81(2): 155–158
Printed in South Africa — All rights reserved

OSTRICH
ISSN 0030–6525 EISSN 1727–947X
doi: 10.2989/00306525.2010.488429

Short Note

Disconcerting trends in populations of the endangered Sokoke Scops Owl *Otus ireneae* in the Arabuko-Sokoke Forest, Kenya

Munir Z Virani[1,2]*, Peter Njoroge[2] and Ian Gordon[3]

[1] The Peregrine Fund, 5668 West Flying Hawk Lane, Boise, ID 83709, USA
[2] Ornithology Section, Department of Zoology, National Museums of Kenya, PO Box 40658-00100, Nairobi, Kenya
[3] Environmental Health Division, icipe – African Insect Science for Food and Health, PO Box 30772-00100, Nairobi, Kenya
* Corresponding author, e-mail: tpf@africaonline.co.ke

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 subpopulations were discovered; in 1992 a small population was discovered in the foothill forests of the east Usambara mountains in Tanzania (Evans et al. 1994), and in 2002 another small population was discovered in the Dakatcha woodlands, 30 km north of ASF (C Jackson and D Ngala, A Rocha Kenya and Arabuko-Sokoke Forest Guides Association [ASFGA], respectively, pers. comm.). With a small and severely fragmented range within which suitable habitat is declining, the species is currently listed as endangered in the IUCN's Red Data List of threatened species (BirdLife International 2008). The ASF, the species' stronghold, covers an area of 417 km^2, of which only about 220 km^2 is suitable habitat for this species.

The ASF has been considered the second-most important forest in Africa for bird conservation (Collar and Stuart 1985). It is home to 270 bird species, 52 mammal species and over 600 plant species (including 10 globally threatened plant species) (Thompson et al. 2007). The ASF is listed as one of the top 20 Important Bird Areas (IBAs) of Kenya that have been prioritised as critical sites for intensive and immediate conservation action (Bennun and Njoroge 1999). Poaching of timber trees, particularly *Brachylaena huillensis* and *Pleurostylia africana*, has significantly affected forest cover with negative impacts on biodiversity in the forest (Fanshawe 1995). The forest also faces habitat degradation threats from an increasing African elephant *Loxodonta africana* population (Glenday 2008). However, the greatest threat to the forest remains human encroachment and long-standing threats to degazette parts of the forest for human settlement (Gordon and Ayiemba 2003).

The escalation of threats and human population pressure notwithstanding, the Sokoke Scops Owl population of the ASF has remained relatively stable at about 7–8 pairs km^{-2} since 1979 (Britton and Zimmerman 1979, Kelsey and Langdon 1984, Virani 1995, Virani 2000). 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 97 km^2 (Evans 1997), while only eight individuals have been recorded at Dakatcha (D Ngala, ASFGA, 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 a 1993 survey by Virani (2000).

The ASF (03°20′ S, 39°59′ E) lies 110 km north of Mombasa at the Kenyan coast. Call surveys of the species were conducted in the *Cynometra* woodland of the forest. This habitat type occurs predominantly on red magarini soils in the western part of ASF with average canopy height ranging from 4 m in thickets to 15 m in forested areas (Britton and Zimmerman 1979, Kelsey and Langdon 1984, Virani 2000). Owl monitoring transects were set up and georeferenced at the following four locations in the forest: Jilore, Kararacha, Dida and Nyari (Figure 1). These locations were named based on their proximity to respective forest station outposts. 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 (Thompson et al. 2007).

Owl densities were estimated using the call-playback method as described by Kelsey and Langdon (1984) and also 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 5 min were recorded with reference to pitch (high or low), estimated distance of call, and bearing. The high pitch call of the males is often crisp, loud, clear and more assertive than the low pitch call often uttered by females, which is soft, muffled and less frequent (Virani 1995). Each high-pitched owl call was considered that of a territory holding male and,

Ostrich is co-published by NISC (Pty) Ltd and Taylor & Francis

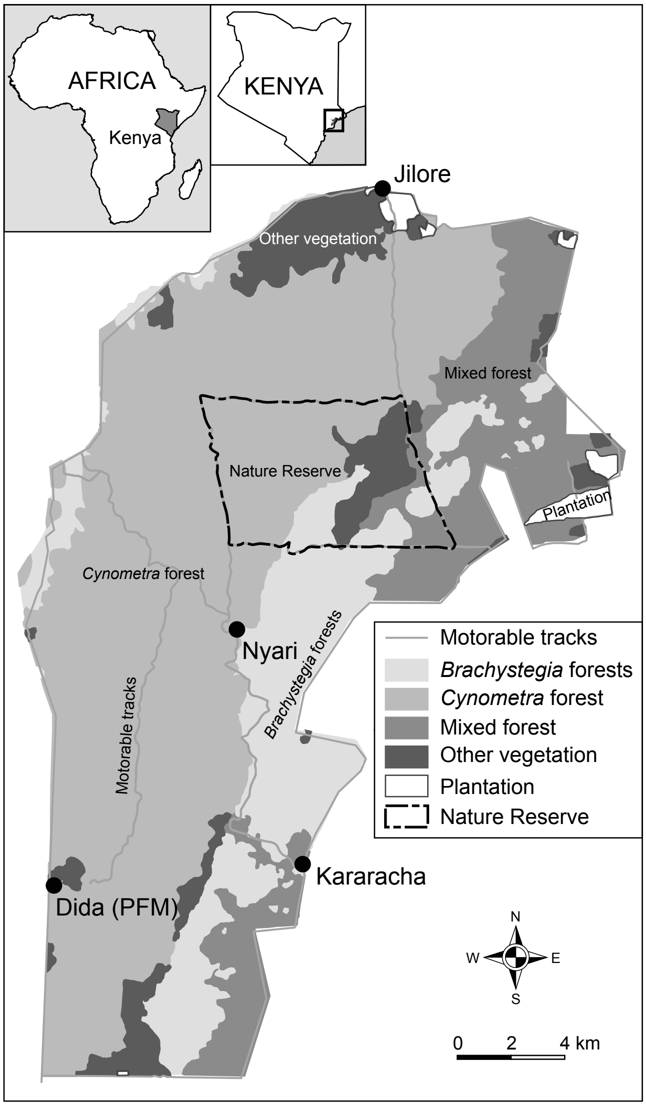

Figure 1: Map of Arabuko-Sokoke Forest showing the four study locations. PFM = Participatory Forest Management

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 for density calculations. Sixty-seven transects (Jilore: 26 transects; Kararacha: 16; Dida: 13; Nyari: 12) were surveyed during April and September 2005, while 34 transects (Jilore: 11 transects; Kararacha: eight; Dida: eight; Nyari: seven) were surveyed during February and March 2008. These transects included 12 at Jilore and Kararacha used in the 1993 density surveys by Virani (1995). Though the calling intensity of spontaneously calling owls is known to be affected by time of the night and the phase of the moon (Britton and Zimmerman 1979, Virani 2000), studies by Virani (1995) have shown that this did not affect the response of territory-holding pairs to playback calls. The maximum distance that an owl could be heard was 250 m (Virani 2000). Based on the number of calling pairs within a 1 000 m by 500 m transect block, we calculated owl densities as pairs per km^2.

Owl densities in the ASF recorded during 2005 and 2008 were not significantly different (mean ± SD: 2005 = 6.1 ± 3.31; 2008 = 5.7 ± 3.06; Mann-Whitney test: $U = 1040$; $P > 0.47$). Similarly, these densities were lower, but not significantly different, from those recorded in 1993 by Virani (1995) (mean ± SD: 6.7 ± 3.26; Kruskal-Wallis test: $H = 2.7$; $P > 0.26$).

Owl densities were significantly higher at Jilore, Kararacha and Dida than at Nyari (Kruskal-Wallis test: $H = 15.7$; $P = 0.01$; Table 1). However, densities were consistently higher at Jilore and Dida than at any other site within the ASF throughout all the years (Table 1). Overall, our data showed a steady, albeit not statistically significant, decline in owl densities at all the sites between 1993 and 2008, with the greatest declines being at Kararacha (Figure 2).

Although these declines are non-significant from a statistical perspective, a decline of 22.5% in Sokoke Scops Owl densities over a 16-year period is of major conservation concern for an endangered species. This would imply that the current population estimate of owl pairs in the ASF is about 800 pairs, down from 1 025 pairs estimated by Virani (2000). Of particular concern is that our observed overall density is considerably lower than the 7–8 pairs km^{-2} 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 much over the last 20 years (ASFMT 2002), illegal removal of trees (especially *Brachylaena huillensis* for carving wood) has continued, albeit at different intensities, 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.

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 (Thompson et al. 2007). This is despite the success of several community-based projects including the Kipepeo Project (Gordon and Ayiemba 2003) and the formation of a local bird-guide association (ASFGA), which have provided financial incentives to the local communities. Proposals to degazette some parts of the forest around Kararacha to pave way for human settlement appear to have stalled (MV pers. obs.), but human population pressure around the forest 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 probably reflect differences in both the condition and structure of the forest and human population pressure, but this warrants further studies. The surrounding areas

Table 1: Numbers of Sokoke Scops Owl pairs per km^2 at various sites in 1993, 2005 and 2008 in the Arabuko-Sokoke Forest

Site	1993	2005	2008
Jilore	7.3	6.8	6.7
Kararacha	6.2	5.1	4.0
Dida PFM	no data	7.8	7.0
Nyari	no data	4.3	4.3
Overall mean (±SD)	6.7 ± 3.26	6.2 ± 3.31	5.7 ± 3.05

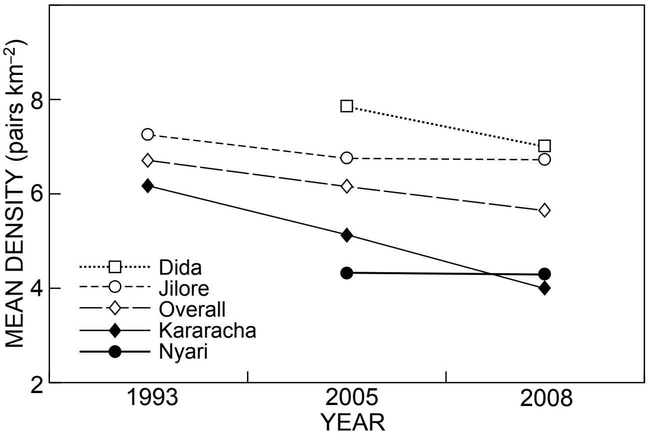

Figure 2: Population density trends of Sokoke Scops Owl pairs in the Arabuko-Sokoke Forest

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 to destruction by elephants. Previously, fewer mature trees and more scattered tree stumps were recorded at Jilore than the other sites (Virani 2000) indicating a high degree of human disturbance. The PFM project at Dida appears to be working, since relatively higher Sokoke Scops Owl densities were recorded at this site, albeit this site also showed a declining trend.

This study has demonstrated a declining population trend of the Sokoke Scops Owl in the ASF. The species' global prospects may have been improved by the discovery of the Usambara and Dakatcha populations, but this was not sufficient to improve its IUCN threat status (BirdLife International 2008). Thus, early conservation action to help reverse the trend, or to ensure that the population does not decline any further, is necessary because ASF is the species' global stronghold.

We propose research activities in the following three areas that will provide information essential for the conservation of this species. Firstly, further intensive exploratory surveys in suitable habitats in areas north of Dakatcha to the southern coast of Somalia are required, since the species is believed to have historically ranged throughout the East African coast (Collar and Stuart 1985). Secondly, that studies are undertaken of the species' breeding biology, population structure, survival and how these factors relate to various habitat characteristics such as densities of mature trees. Thirdly, monitoring studies such as this one, but also including a measurement of forest health, need to be sustained in the long term for Sokoke Scops Owl populations in the ASF, Dakatcha and Usambara forests, to help understand the species' population viability and the nature of population trends, such as the one described in this paper. For example, will the observed declines at ASF persist, recover as the forest health improves, or is it a natural population oscillation?

Acknowledgements — This study is part of The Peregrine Fund's Pan African Raptor Conservation Program and was funded by grants from The Peregrine Fund and the Disney Wildlife Conservation Fund. Additional support was provided by grants obtained by Nature Kenya and a GEF-UNDP grant to the Commercial Insects Programme at *icipe* – African Insect Science for Food and Health. We are indebted to Simon Thomsett, David Ngala, Wellington Kombe, Colin Jackson, Alex Ngari and Francis Kagema for their help towards the surveys. We are thankful to Kenya Wildlife Service and, in particular, the warden of the Arabuko-Sokoke Forest for their assistance and permission to conduct surveys in the forest.

References

ASFMT [Arabuko-Sokoke Forest Management Team]. 2002. Arabuko-Sokoke Forest strategic forest management plan 2002–2027. Available at http://www.birdlife.org/action/ground/arabuko/arabuko_sokoke_plan.pdf [accessed 16 January 2009].

Bennun LA, Njoroge P. 1999. *Important Bird Areas in Kenya*. Nairobi: Nature Kenya.

BirdLife International. 2008. The global Red Data List of threatened species. Cambridge: BirdLife International.

Britton PA, Zimmerman DL. 1979. The avifauna of Sokoke Forest, Kenya. *Journal of the East African Natural History Society and National Museum* 169: 1–15.

Collar NJ, Stuart SN. 1985. *Threatened birds of Africa and related islands: the ICBP/IUCN red data book, part 1*. Cambridge: International Council for Bird Preservation and International Union for Conservation of Nature and Natural Resources.

Evans TD. 1997. Preliminary density estimates of the population density of the Sokoke Scops Owl *Otus ireneae* in the East Usambara lowlands, Tanzania. *African Journal of Ecology* 35: 303–311.

Evans TD, Watson LG, Hipkiss AJ, Kiure J, Timmins RJ, Perkin AW. 1994. New records of Sokoke Scops Owl *Otus ireneae*, Usambara Eagle Owl *Bubo vosseleri* and East Coast Akalat *Sheppardia gunningi* from Tanzania. *Scopus* 18: 40–47.

Fanshawe J. 1995. The effect of selective logging on the bird community of the Arabuko-Sokoke Forest, Kenya. PhD thesis, University of Oxford, UK.

Glenday J. 2008. Carbon storage and emissions offset potential in an African dry forest, the Arabuko-Sokoke Forest, Kenya. *Environmental Monitoring Assessment* 142: 85–95.

Gordon I, Ayiemba W. 2003. Harnessing butterfly biodiversity for improving livelihoods and forest conservation: the Kipepeo project. *Journal of Environment and Development* 12: 82–98.

Kelsey MG, Langdon TES. 1984. The conservation of Arabuko-Sokoke Forest. ICBP Study Report No. 4. Cambridge: International Council for Bird Preservation.

Ripley SD. 1966. A notable owlet from Kenya. *Ibis* 108: 136–137.

Thompson HS, Eshiamwata G, Githiru M, Matiku P, Ayiemba W. 2007. *Enhanced sustainability at Arabuko-Sokoke Forest: conservation successes, challenges and lessons learnt*. Nairobi: Nature Kenya.

Virani MZ. 1995. Ecology of the endangered Sokoke Scops Owl *Otus ireneae*. MSc thesis, University of Leicester, UK.

Virani MZ. 2000. Distribution and population size of the Sokoke Scops Owl *Otus ireneae* in the Arabuko-Sokoke Forest, Kenya. In: Chancellor RD, Meyburg B (eds), *Raptors at risk – proceedings of the 5th World Conference on Birds of Prey and Owls, Johannesburg, 4–11 August 1998*. pp 795–801. Berlin: World Working Group on Birds of Prey; Surrey, Hancock House.

Wairungu S, Awimbo J, Kigomo B. 1993. An ecological study of the nature reserve within Arabuko-Sokoke Forest Reserve. Unpublished NMK/WWF Coast Forest Survey Report. WWF project number 3256.

Received March 2009, accepted March 2010
Editor: M Githiru