An ornithological survey of Elementaita, Kenya: towards consideration for Ramsar site status

Henry K. Ndithia and Timothy Mwinani
Department of Ornithology, National Museums of Kenya, P.O. Box 40658 – 00100, Nairobi, Kenya

Abstract
A 16 days bird survey was conducted at Soysambu, Elementaita in April 2005 in three different habitats – Thicket woodland, woodland with shrub understorey and open grassland with scattered woods. The survey was conducted by a combination of mist-netting, bird walk, vegetation measurements and point counts. An effort of 5 mist-netting hours per day for two consecutive days was applied in each habitat type, coupled with 5 hours of intensive bird walk and 3 hour of point count once in each habitat type. Vegetation was measured through visual estimation along each mist net transect. A total of 166 species consisting of 16 Palaearctic migrants, 6 Afrotropical migrants and three listed as threatened were recorded from the three habitats. Jaccard's similarity index showed a lacked of similarity in species composition between the three habitat types with over 129 individual birds of 35 species that were captured and ringed from these habitats under consideration. Thicket woodland and open area with scattered woods were the habitat types with the most diverse species composition and number of bird individuals caught. There was significant difference between vegetation variables in thicket woodland and Open Woodland, $p = 0.0049$, but the other habitat types were similar.

Introduction

Tourism at Elementaita is increasing, the main attraction being the scenery, birdwatching and the chance to see unusual animals by night. Being a wetland in a semi-arid zone, the area has a unique microhabitat with varied animal populations. The woodland and bushland are rich in birdlife (over 400 species have been recorded). Lesser Kestrel (vulnerable) occurs there on passage and the vagrant greater spotted Eagle (vulnerable) and the red-throated Tit (near-threatened) have been recorded (Turner 1977). Other threatened birds that occur at this site include great crested Grebe (critical), Great Egret (vulnerable), white-headed Vulture (Vulnerable), Ayrs's Hawk Eagle (Vulnerable), African Crowned Eagle (Vulnerable), Martial Eagle (Vulnerable), yellow-billed Oxpecker (Vulnerable) and long-tailed Widowbird (Vulnerable) (Zimmerman *et al* 1996, Oyugi *et al* 1993)

The threatened (vulnerable), restricted-range Grey-crested Helmet-Shrike occurs in the surrounding woodland and Jackson's Widowbird (near-threatened, restricted-range) has breeding areas in the grassland. The lake consistently holds internationally important populations of Greater and Lesser Flamingos (lesser Flamingos: near-threatened) and Pied Avocet. At least 49 waterbird species are recorded, including 10 Palaearctic migrants. It is also host to a large number of Great White Pelicans; up to about 8,000 pairs of which have bred there (Richards 1991). There has been occasional, but unsuccessful, breeding attempts by the near-threatened Lesser Flamingo (Brown 1973) eason for the survey-

The study area

Lake Elementaita, $0^0$27'S, $36^0$15'E is a shallow alkaline lake (maximum depth 1.9m) lying on the floor of the Rift Valley some 20km south-east of Nakuru town (Bennun and Njoroge 1999). It is fed by Kekopey hot springs and two small streams, the Mereroni and Kariandusi. Rainfall is erratic and less than 600mm per year, and the lake is known to dry out completely in some seasons, leaving out a concentrated salt pan particularly due to increased water off take from Mereroni stream (Bennun and Njoroge 1999).

The lake is flanked by small-scale agriculture to the eastern side, while several large ranches surround the rest of it. The natural vegetation is mainly *Acacia* and *Tarchonanthus camphorates* bushland. Patches of *Acacia xanthophloea* woodland occur near the shore. The IBA consists of the lake and its surrounding shoreline, including the hot springs and the cliffs, and the Soysambu Wildlife Sanctuary, where the study was carried out.

Subsistence farming on the eastern side is leading to increased siltation of the lake from soil erosion. Local communities extract soda from the lake for their livestock and sand for the construction industry, activities that, coupled with grazing pressure, may pose problem in the future.

The IBA supports congregations of wildlife. More than 20,000 waterbirds have been recorded (1992-97 January, mean: 171,000.Max: 486,000 (1994). The site has 1% or more of biogeographic population of a number of species (Bennun 1992a, Nasirwa & Bennun 1994, 1995, unpubl. data).

Methods

Bird survey

Birds were surveyed by a combination of Mist-netting, point counts and bird walks in three habitat types- thicket woodland (TW), woodland with undergrowth (WwU) and open woodland with scattered woods and bush patches (OW). Narrow strips of understorey vegetation were cleared at each site and mist nets 3 m high and 102m long were laid. Nets were run for two consecutive morning sessions at each site between 6.30 am and 11.30 am (an average of 5 mist-netting hours).

Point counts

Point counts were conducted following *Bibby et al* (1998) and Bibby and Burgess (1997) once in the afternoon (from 3.00pm to 5.00pm) at each site after the second mist-netting day randomly at each habitat type under study. Initial points location was selected randomly followed by several other point locations 100m apart and along transects of 1000M. At each location on the point count transect 5 minutes were allowed after arrival to let "things to settle in" after the survey team arrival at the location. Birds were later assessed for 10 minutes through site and sound and the number, species and activity of the bird were recorded.

Vegetation structure and habitat complexity were visually estimated within each habitat type following the Braun-Blanquet scale for visual estimation of vegetation cover (Bullock 2002) This involved walking along the mist-netting transect and measuring the vegetation parameters at different point in a 1x1m^2 plot and at intervals of 20 m. A chequered board (with 25 series of red and brown squares) was used to estimate the shrub layer density of the site by estimating the percent obscurity by vegetation. The following vegetation parameters were recorded at each point: canopy height (in m and to the nearest m) percentage canopy cover; shrub cover and herb layer cover. The amount of dead wood on trees and on the ground, and the dung layer covering the ground was also estimated.

Data Analysis

Several procedures were used to compare bird species richness among the three habitat types. Analysis of variance (ANOVA) was used to compare the vegetation characteristics.

Jaccard's similarity index: $S_j = \alpha/\alpha+\beta+\delta$; (Krebs 1994), where α = joint occurrence of species in fragments A and B; β = number of species in fragment B but not in A; δ = number of species in fragment A but not in B was used to assess the similarities in species composition in the three habitat types and the degree to which the species and their relative abundances are shared between different bird communities. Sites with similarity value of more than 0.5 were considered highly similar and vice versa. Shannon-Wiener Diversity index: $H' = - \Sigma\ p_I\ .\ \ln\ (pi)$; (Bibby *et al* 1998) where *pi* is the proportion of species I expressed as a proportion of the total number of individuals of all species, ln is the natural logarithm, and Σ represents the total $p_I\ .\ \ln\ (pi)$ for all species, ,was used to as a means of combining the species richness (total number of species and the extent to which all species are equally common).

Results

Bird species composition

A total of 166 species, consisting of 16 Palaearctic migrants and 6 Afrotropical migrants, were recorded from the three habitat type; thicket woodland, woodland with understorey shrubs and open area with scattered woods, during the two week survey. Three species listed as threatened: the restricted-range Grey-crested Helmet-Shrike, Lesser Kestrel and the white-headed Vulture were recorded in the three habitat types.

Mist-netting data

Over 129 individual birds of 35 species were captured and ringed from the habitats under study. Thicket woodland and open area with scattered woods were the habitat types with the most diverse species composition and number of bird individuals caught (see table 1)

Analysis showed a lacked of similarity in species composition between the three habitat types. However, there was more similarity between thicket woodland and woodland with shrub undergrowth than between the later and the open woodland with scattered woods and between thicket woodland and open woodland with scattered woods (table 2).

Vegetation structure

Mean canopy height for the three habitat types ranged from 14 to 23 m, canopy cover from 24 to 57 %, shrub cover from 14 to 39% and herb cover from 29 – 32%. There was no significant difference between vegetation variables in woodland with shrub undergrowth and open woodland, $p = 0.077$, and in thicket woodland and woodland with shrub undergrowth, $p = 0.665$, but there was significant difference between vegetation variables in thicket woodland and Open Woodland at Elementaita, $p = 0.0049$

Discussion

Open woodland had the highest species diversity of the three habitats (table 1) despite this habitat having the lowest total vegetation cover (TVC). The open woodland was mainly a grassland area with few patches of scattered woodlands of a mean canopy height of 14.6m (range 7 -27.5m). The relatively high diversity of this habitat may have been due to the fact that the mist-nets covered almost the entire height range (or most part of the height) of the habitat, so that the species which in other woodland types would not have been caught in the nets were caught in this woodland type.

By visual observation woodland with shrub undergrowth had the highest total vegetation cover (table 3), although it was not significantly different from the thicket woodland (see results). This complexness was not however reflected on the species composition and diversity, as it had the lowest diversity, number of bird individuals caught and the number of species (table 1). Mist nets catch understorey birds up to 3 m, a fact that made it possible for more species and individuals to be caught in thicket woodland (with more thicket and hence understorey) than in the more scattered understorey in the woodland with understorey. Due to the high canopy of both the thicket woodland and woodland with scattered shrubs, information of species composition at this layer was not captured through mist-netting and the picture is expected to be different were these layers assessed.

Analysis has shown that bird communities of the three habitats lacked similarity even in habitats whose vegetation variables did not differ significantly (see section on results: vegetation structure), table 2 (none of the habitats had a similarity index of 0.5 or more).

Table 1: Analysis of mist net catches in different habitats types around Lake Elementaita

Habitat type	Diversity	Number of birds	Number of species
TW	2.43	70	19
WwU	1.74	19	8
OW	2.49	37	16

Where TW = Thicket woodland of Acacia, WwU = Woodland with shrub undergrowth and OW = Open grassland with scattered woods

Table 2: Similarity indices of bird communities from different habitat types at Elementaita

	Thicket woodland	Open woodland
Woodland with Undergrowth	0.24	0.12
Thicket woodland		0.11

Table 3: Mean vegetation parameters of the three habitat types of Elementaita

Habitat type	Canopy height, m	Shrub Cover, %	Herb cover, %	Canopy cover, %	Total veg. Cover, %
Thicket Woodland	16.2 ± 2.9	21.1 ± 3.8	31.5 ± 14.8	24.1 ± 16.6	92.9
Woodland with shrub undergrowth	22.4 ± 3.8	38.1 ± 26.7	31.0 ± 12.8	56.5 ± 8.1	148
Open Woodland	14.6 ± 7.7	14.4 ± 11.7	29.5 ± 18.8	30.2 ± 18.3	88.7

Point count

Habitat selection was one of the most poorly understood in relation to ringing data collected and the ecological processes. There was an enormous variation in the habitat selection in the species density of individual in different habitat. In thicket woodland No of bird species were more than open woodland byhalf

Habitat type	Number of birds	Number of species
TW	30	19
WwU	16	10
OW	7	3

APRIL EARTHWATCH SOYSAMBU RANCH ON LAKE ELEMENTAITA BIRDS CHECKLIST

Serial No.	EA& NO.	SPECIES NAME	SCIENTIFIC NAME	13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	20	Great white Pelican	Pelecanus onocrotalus	[													
2	26	Great Commorant	Phalacrocorax carbo				[				[						
3	38	Little Egret	Egretta garzetta								[				[		[
4	42	Common squacco Heron	Ardeola ralloides								[						
5	58	Marabou Stork	Leptoptilus crumeniferus			[	[				[						
6	59	Open billed Stork	Anastomus lamelligerus			[											
8	60	Yellow billed Stork	Mycteria ibis														
9	61	Sacred Ibis	Threskiornis aethiopicus	[			[		[							[	[
10	62	Hadada Ibis	Bostrychia hagedash	[	[	[	[	[	[		[	[	[	[	[	[	[
11	69	Lesser Flamingo	Phoeniconaias minor	[	[	€					[						
12	74	Egyptian Goose	Bostrychia hagedash	[	[						[						
13	80	Cape Teal	Anas capensis	[							[						
14	95	Secretary bird	Sagittarius serpentarius														
15	100	Black shouldered Kite	Elanus caeruleus				[				[						
16	102	Black Kite	Milvus migrans	[	[						[				[		
17	106	African white backed Vulture	Gypes africanus												[		[

18	107	Ruppell's griffon Vulture	Gyps rueppellii					[							[		[
19	109	White headed Vulture	Trigonoceps occipitalis									[					[
20	117	African Harrierhawk	Polyboroides typus				[	[									[
21	120	African Marsh Harrier	Circus ranivorus														
22	121	Eurasian Marsh Harrier	Circus aeruginosus			[		[	[								
23	123	Dark chanting Goshawk	Melierax metabates			[						[					
24	134	Great S parrowhawk		[			[										
25	142	Augur Buzzard		[	[	[	[	[			[	[	[	[	[	[	[
26	143	African Fish Eagle	Haliaeetus vocifer	[					[		[						
27	155	Long crestd Eagle	Lophaetus occipitalis			[	[				[				[		
29	173	Greater Kestrel	Falco rupico								[						
30	176	Lesser Kestrel	Falco naumanii					[						[			
31	204	Helmeted Guineafowl	Numida meleagris											[			
32	222	Black Crake	Amaurornis flavirostris				€				€	€			[		
33	230	Grey crowned Crane	Balearica regulorum								[						
34	246	Pied Avocet	Recurvirostra auosetta											[			
35	265	Kittlitz Plover	Charandrius percuarius											[			
36	266	Threee banded Plover	Charandrius tricollaris											[			
37	278	Blacksmith's Plover	Vanellus armatus											[			
38	279	Spur-winged Plover	Vanellus spinosa											[			
39	284	Crowned Plover	Vanellus coronatus											[			
40	287	Little Stint	Caldris minuta											[			
41	298	Ruff	Philomachus pugnax									[		[			
42	310	Marsh Sandpiper	Tringa stagnatilis											[			
43	311	Common Greenshank	Tringa nebularia											[			
44	312	Green Sandpiper	Tringa ochropus											[			
45	314	Common Sandpiper	Actitis hypoleucas											[			
46	343	Whiskered Tern	Chlidonia hybridus											[			

47	354	Affrican green Pigeon	Treron calva		[	[								[			
48	359	Emerald-spotted Wood dove	Turtur chalcospilos		[	[											
49	361	Namaqua Dove	Oena capensis			[			[		[						
50	370	Red -eyed Dove	Streptopelia semitorquata	[	[	[	[	[	[	[	[	[	[	[	[	[	[
51	371	African morning Dove	Streptopelia decipiens	[	[	[	[	[	[	[	[	[	[	[	[	[	[
52	373	Ring-necked Dove	Streptopelia capicola		[	[				[	[						
53	377	Laughing Dove	Streptopelia senegalensis	[	[					[	[				[	[	[
54	380	Red-fronted Lovebird	Poicephalus gulielmi	[	[	[			[	[					[		
55	384	Red headed Lovebird	Agapornis pullaris	[						[							
56	398	Hartlaub's Turaco	Turaco hartlaubi		[	[											
57	404	Black and White Cuckoo	Oxylophus jocobinus			[		[	[								
58	409	Red -chested Cuckoo	Cuculos solitarius	[	[	[	[	[	[	[	[	[	[	[	[	[	[
59	419	Klaas' Cuckoo	Cuckoo klaas		[	[		[	[								
60	420	Diederik Cuckoo	Chrysococcyx cupreus	[				[	[								
61	422	White browed Coucal	Centropus superciliosus		[	[											
62	476	Alpine Swift	Apus melba							[	[						
63	480	Speckled Mousebird	Colius striatus	[	[	[	[	[	[	[	[	[	[	[	[	[	[
64	486	Grey headed Kingfisher	Halcyon leucocephala												[		
65	491	Striped Kingfisher	Halcy chelicuti							[			[		[		
66	500	Pied Kingfisher	Ceryle rudis										[				
67	511	White fronted Bee-eater	Merops bullockoides										[				
68	513	Beareded Wood Pecker	Dendropicos namaquus										[				
69	514	Cinnamon-chested Bee-eater	Merops oreobates				[						[				
70	519	Lilac breasted Roller	Coracias caudata			[		[		[							
71	522	Broad billed Roller	Eurystomus glaucurus			[										[	
72	524	Hoopoe	Upupa epops							[							

73	527	Green Wood Hoopoe	Phoeniculus purpureus	[			[			[								
74	533	Southern Ground Hornbill	Bucorvus leadbeadteri	[														
75	545	African grey Hornbill	Tockus nasutus							[								
76	564	Red fronted Tinkerbird	Pogoniulus pasillus				[			[								
77	565	Yellow-rumped Tinkerbird	Pogoniuls bilineatus				[			[								
78	568	Red fronted Barbet	Tricholaema diademata				[			[								
79	588	Lesser Honeyguide	Indicator minor			[			[									
80	601	Nubian Woodpecker	Camphethera rubica	[	[	[	[	[	[			[	[					
81	610	Cardinal Woodpecker	Dendropicos fuscescens	[	[			[							[			
82	616	Grey Woodpecker	Dendropicos goertae															
83	650	Banded Martin	Riparia cincta							[								
84	651	plain martin	Riparia paludicola				[			[								
85	657	Wire tailed Swallow	Hirundo smithii				[			[								
86	660	Barn Swallow	Hirundo rustica							[								
87	663	Red -rumped Swallow	Hirundo daurica				[			[								
88	668	Rock Martin	Hirundo futigula				[											
89	673	Afircan Pied Wagtail	Motacilla aguimp	[	[	[	[	[	[	[	[	[	[	[	[	[		
90	681	Grassland Pipit	Anthus cinnamomeus							[								
91	729	Common Bulbul	Pycnonotus barbatus	[	[						[	[			[			
92	739	Arrow-marked Babbler	Turdoides sharpei				[	[					[					
93	746	Ruffous Chatterer	Turdoides rubiginosus				[	[										
94	771	Ruppell's Robin Chat	Cossypha		[		[	[										
95	772	White-browed Robin-Chat	Cossypha heuglini															
96	782	Spotted morning Thrush	Cichladusa guttata		[			[										
97	797	Pied Wheatear	Oenanthe pleschanka				[			[					[			
98	807	Northern anteaterChat	Myrmecocichla aethiops							[					[			

99	816	Olive Thrush	Turdus olivaceus	[	[					[		[						
100	831	African dusky Flycatcher	Muscicapa adusta							[					[			
101	840	White-eyed slaty Flycatcher	Melaenornis fischeri	[	[	[	[	[		[								
102	842	Northern black Flycatcher	Muscicapa edolioiedes							[								
103	845	Pale Flycatcher	Bradornis pallidus				[	[										
104	860	Marsh Warbler	Acrocephalus palustris				[	[										
105	869	Garden warbler	Sylvia borin					[	[									
106	873	Willow Warbler	Phylloscopus trochilus				[											
107	891	Dark-capped Yellow Warbler	Chloropeta natalensis			[	[	[	€									
108	894	Red-faced Cisticola	Cisticola erythrops	[	[	[	[	[	[	[	[	[	[	[	[	[		
109	906	Winding Cisticola	Cisticola galactotes	[	[	[	[	[										
110	912	Rattling Cisticola	Cisticola chiniana	[	[	[	[	[	[	[	[	[	[	[	[	[		
111	923	Wing-snapping Cisticola	Cisticola ayresii			[				[								
112	924	Tawny-flanked Prinia	Prinia subflaver			[	[	[										
113	925	Pale Prinia	Prinia somalica			[	[											
114	936	Yellow breasted Apalis	Apalis flavida															
115	936	Yellow breasted Apalis	Apalis flavida			[	[			[								
116	945	Grey Apalis	Apalis cinerea					[						[	[			
117	957	Grey capped Warbler	Eminia lepida		[	€	[											
118	963	Red-faced Crombec	Sylvietta whytii					[				[		[				
119	978	Banded Barisoma	Parisoma boehm											[				
120	990	White bellied Tit	Parus albiventris								[	[						
121	1007	African paradise Flycatcher	Terpsiphone viridis				[							[				
122	1013	Chin-spot Batis	Batis molitor				[											
123	1020	Black-throated Wattle-eye	Platisteira peltata												[			
124	1026	Grey crested-Helmet-Shrike	Prionops poliolophus											[	[			
125	1032	Red backed Shrike	Lanius collurio								[	[						
126	1039	Grey backed Shrike	Lanius excubitoroides															

127	1043	Common Fiscal Shrike	Lanius collaris	[			[			[	[		[					
128	1048	Brown crowned Tchagra	Tchagra australis								[							
129	1064	Tropical Boubou	Laniarus aethiopicus	[	[	[	[	[	[	[	[	[	[	[	[	[		
130	1070	Slaty-coloured Boubou	Laniarus funebris	[	[	[												
131	1071	Northern Puffback	Dryscopus gambensis			[	[	[	[	[								
132	1072	Black-backed Puffback	Dryoscopus Cubla	[	[						[	[						
133	1080	Grey Cuckoo	Coracina caesia				[	[	[									
134	1082	Common Drongo	Dicrurus adisimilis	[	[	[	[	[	[	[	[	[	[	[	[	[		
135	1087	Black headed Oriole	Oriolus larvatus	[	[	[	[	[	[	[	[	[	[	[	[			
136	1095	Pied Crow	Colvus albus		[													
137	1111	Greater Blue-eyed Starling	Lamprotornis chalybaeus	[	[	[	[	[	[	[	[	[	[	[	[			
138	1118	Superb Starling	Lamprotornis superbus	[	[	[	[	[	[	[	[	[	[	[	[			
139	1130	Yellow billed Oxpecker	Buphagus africanus	[	€										[	[		
140	1140	Collared Sunbird	Anthreptes collaris				[	[							[	[		
141	1146	Green headed Sunbird	Nectarinia verticalis											[	[	[		
142	1149	Amethyst Sunbird	Nectarinia amethystina											[	[	[		
143	1150	Scarlet-cheasted Sunbird	Nectarinia senegalensis				[	[						[	[			
144	1152	Variable Sunbird	Nectarinia venusta								[				[	[		
145	1159	Northern double collared Sunbird	Nectarinia preussi											[	[			
146	1165	Marico Sunbird	Nectarinia mariquensis											[	[	[		
147	1170	Red-chested Sunbird	Nectarinia erythrocerca											[	[	[		
148	1179	Bronze Sunbird	Nectarinia kilimensis								€			[	[			
149	1185	Rufous Sparrow	Passer rufocintus								[							
150	1187	Grey headed sparrow	Passer griseus				[				[							
151	1200	Grey-capped Social Weaver	Pseudonigrita arnaudi				[											
152	1205	Baglafecht Weaver	Plocues baglafechti				[						[					
153	1210	Spectacled Weaver	ploceus ocularis										[					

154	1228	Lesser masked Weaver	Ploceus intermedius										[					
155	1236	Chestnut Weaver	Ploceous rubiginosus							[			[					
156	1250	Red billed Quelea	Quelea erythrops							[			[					
157	1258	Yellow Bishop	Euplectes capensis							[			[					
158	1293	Billed firefinch	Logonosticta Senegala										[					
159	1294	Afican firefinch	Logonosticta rubricata										[					
160	1303	Common wax bill	Estrilda astrild															
161	1309	Red-cheecked Cordon-bleu	Uraeginthus bengalus	[	[	[	[	[	[	[	[	[	[	[	[	[		
162	1346	Yellow-rumped Seed-eater	Serinus reichenowi							[								
163	1247	Red headed Weaver	Anaplectes rubricebs												[			
164	51	Black headed Heron	Ardea melanocephala								[				[			
165	1112	Lesser blue eared Starling	Laprotornis chloropterus		[	[	[	[	[			[	[	[	[	[		
166	1311	Purple Grenadier	Uraeginthusianthinogaster											[	[			

References

Krebs, C. J. 1994 Ecological methodology. Addison-Wesley Publishers, CA

Bennun, L. and Njoroge, P 1999 Important bird areas in Kenya, Nature Kenya, Nairobi

Bennun, L. A. 1992a. Summary results of the January 1992 waterfowl counts, *Research report of the centre for Biodiversity, National Museums of Kenya: Ornithology 7*

Bibby, C., Jones, M. and Marsden, S. 1998 expedition field techniques; bird surveys, expedition advisory centre, London

Bibby, C. J., Burgess, N. D. and Hill, D. A. 2000. Bird census techniques, Academic press, London

Bullock, J. 2002 Plants In: W. J. Sutherland (ed) ecological census technique pp 111-138, Cambridge University press, Cambridge

Nasirwa, O. and Bennun, L. A. 1994. Waterbird counts in Kenya, ,July 1993 and January 1994, *Research report of the centre for Biodiversity, National Museums of Kenya: Ornithology 17*

Nasirwa, O. and Bennun, L. A. 1995. Monitoring of waterbird counts, *Research report of the centre for Biodiversity, National Museums of Kenya: Ornithology 7*